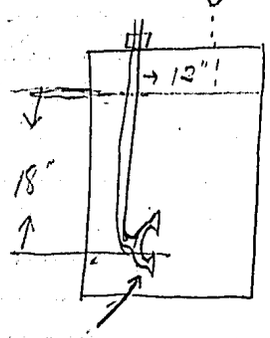
Notebook Series -- Notebooks by Experimenters Other Than Edison
General Experiment Books -- W. A. Hayes Book
Notebook, N-18-10-25

This notebook was used by William A. Hayes during the periods October 1918 and October 1920-March1922 for experimental notes on a variety of subjects. At the beginning and end of the book are a few notes from 1918 describing experiments with depth meters for ships. The remaining entries, covering the years 1920-1922, pertain primarily to experiments with recorders for disc phonographs involving a variety of diaphragms, gaskets, and recording arms. There are also experiments on wax master blanks with varying ingredients. Many of the phonograph entries include notations by Hayes regarding Edison's instructions, comments, or opinions. Numerous items, including some with notations by Edison, have been affixed onto or between the notebook pages. In addition, several loose items from 1922 (by Hayes) and 1925-1926 (by F. C. Burt) have been inserted into the book. The book contains 4 unnumbered pages, followed by 127 numbered pages (some blank), and 23 additional unnumbered pages.

Oct 25 1918

In Garage



Pipe on sponges
3/4" pipe

8 feet brass pipe

2 diaphragms hard rubber 1/8" thick and 1 5/16" diameter

Hayes 50 - on boxed

Used Bell Magneto + 3 stage

#2

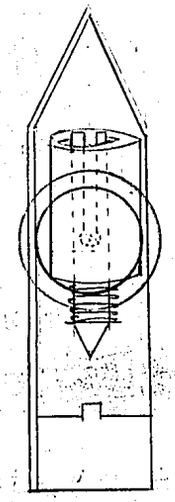
Same as above only use 4 hard rubber diaphragms 1/8" thick - and 1 5/16" diameter

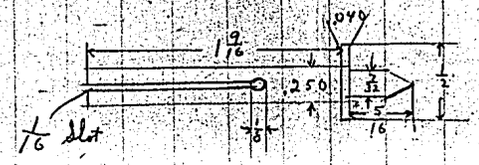
Hayes 50 on boxed

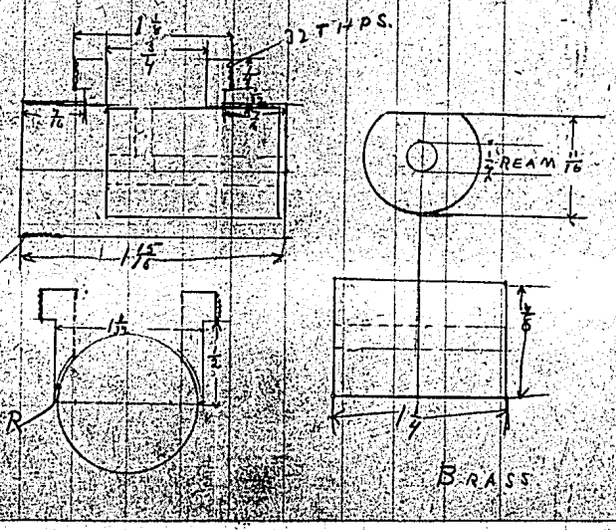
Same conditions in both tests and results were same

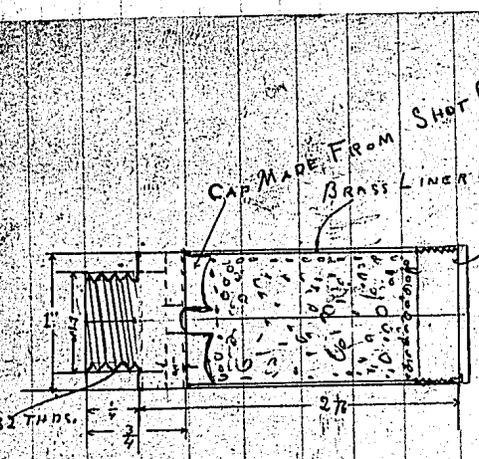
Instrument to detect depth of water a vessel is travelling in.

The idea is to allow cartridge over board and then pressure of water act on diaphragm in such a manner as to cause an explosion, same to be heard on board.

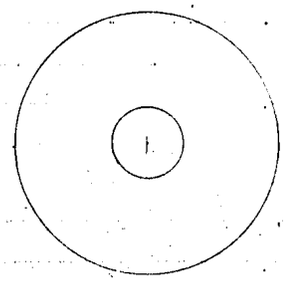


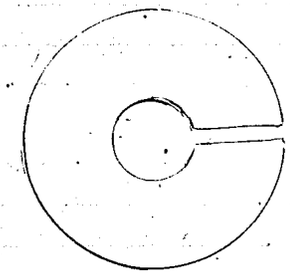

1 9/16
.250
.040
1/2
3/32
.5
5/16
1/16 slot
1/8

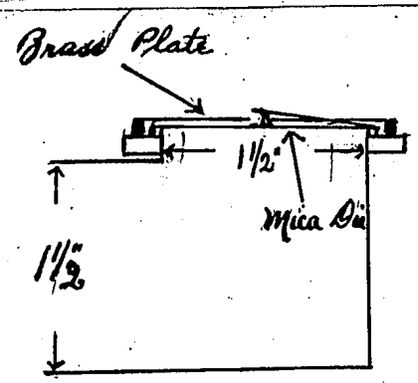

32 TAPS.
REAM
BRASS

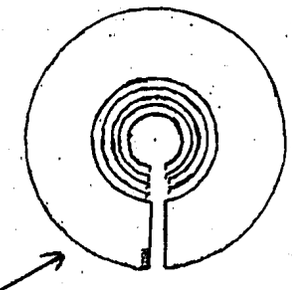

CAP MADE FROM SHOT GUN CARTG.
BRASS LINER DRILL FULL ¼" HOLES
BRASS PLUG
1"
32 THDS.
2¼

.675
.875



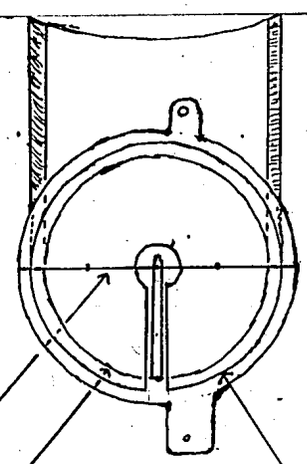






Plates 1/32" Brass stock with centres cut out for recording arm

Centre openings measure from 1/4" to 1"



Wire 7/1000 stretched across diaphragm

Mica diaphragm, laminated
.004 — .001 — .001 — .001 — .001
Dia. .004 1 5/8 diameter. 1st. lamination 1 1/4" 2nd 15/16" 3rd. 5/8" 4th 3/8"

Brass Plate center opening for recording arm

31 1/2
31 1/2
3
66

95
66
28 1/2

83
66
17
125
66
9

1/32" = .031 1/2 —
1/16 .062 1/2
1/8 .125

31 1/5
156
10) 156 (15 3/5
10
56

62 1/2
34
28 1/2

3/64 1/16 — 5/64 — 3/32 — 7/64
3/64 — 4/64 — 5/64 — 6/64 7/64 8/64

48

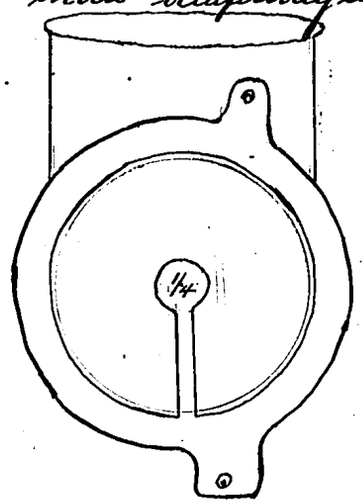
2/64 2/64
7/64 4/64 6/64 3/64

1/64 2/64
3/64

5 October 1920

1st trial piano 9½ feet away

plate with 1/4" hole in centre covering mica diaphragm on outside.



Cushioning space between diaph. and plate 1/16"

Result: Too muffled and sensitive

October 1920

2nd Trial Piano 9½ feet away

Plate with 3/8" hole in centre

Cushioning space between diaphragm and plate 1/16"

Result: not so muffled as plate with 1/4" centre hole, but still sensitive and not clear enough.

October 1920

3rd Trial Piano 9½ feet away

Plate with ½" hole in centre

Cushioning space between diaphragm and plate 1/16"

Result: Not as muffled as 3/8" hole in centre, but still too sensitive compared with #5

#11

October 1920

4th Trial Piano 9½ feet away

Plate with 5/8" hole in centre

Cushioning space between diaphragm and plate 1/16"

Result: More clear than 1/2" hole and holds a little better.

#13

October 1920

5th Trial Piano 9½ feet away

Plate with ¾" hole in centre

Cushioning space between diaphragm and plate 1/16"

Result: Clearer than 5/8" hole in centre but is weaker

October 1920

6th Trial Piano 9½ feet away

Plate with 7/8" hole in centre

Cushioning space between diaphragm and plate 1/16"

Result: Clearer and weaker than 3/4" hole.

October 1920

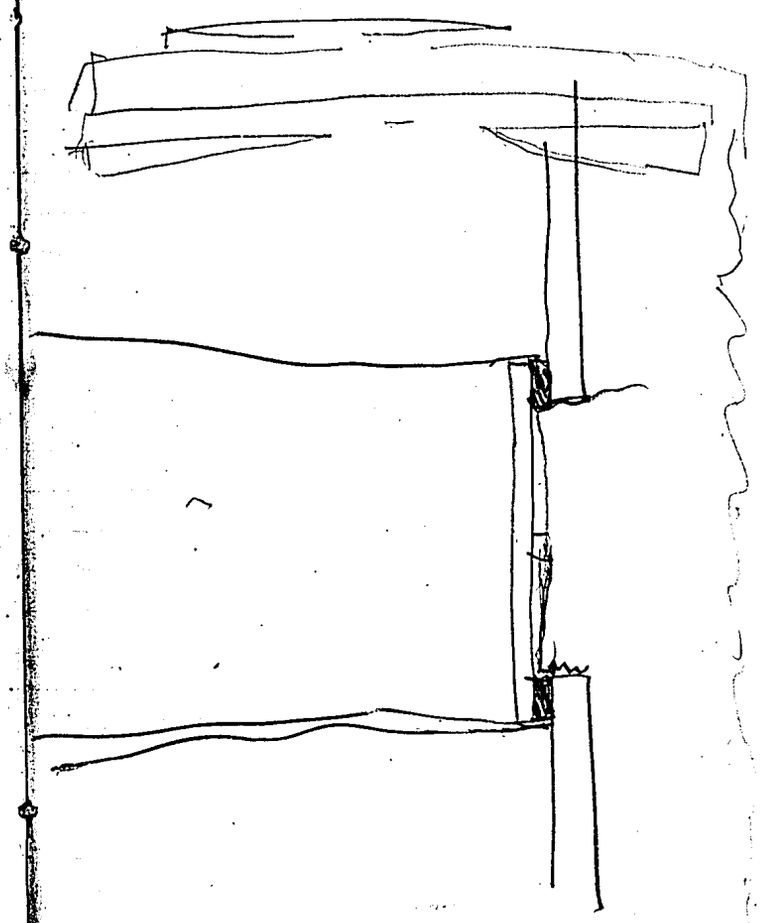
I now cut plates down 1/32 that is make the cushioning space between diaphragm and plate 1/32" instead of 1/16".

After making trials of the six plates I find that from 1/4" to 5/8" the results are big tone and if anything somewhat muffled. 5/8" hole in centre is very good, in fact best obtained up to present. Above 5/8" results thinner and weaker.

October 1920

As the plate 1/32 cushioning space 5/8" hole in centre is very good but if anything weaker than desired. and as a 1/16 cushioning space was more sensitive, I decide to try a plate tapering from 1/32 to a knife edge centre, which means that when in place the cushioning space near edge of diaphragm will be 1/32 and in the centre 1/16

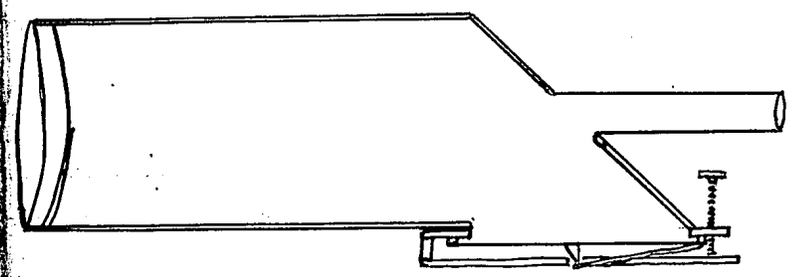
See pages #41 – 43 – 45



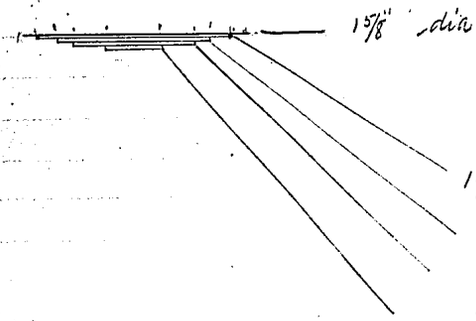
17

27

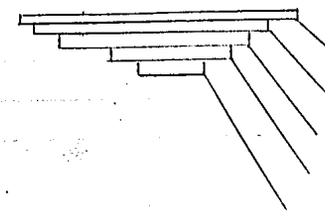
Oct 1920



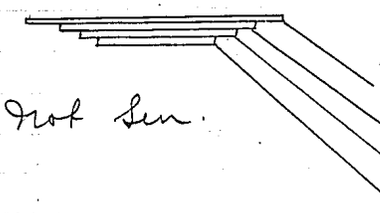
#1


1 5/8" dia .004
1 3/8" .002
1 1/8" .001
7/8" .001
3/8" .001

#2


1 5/8" dia .005 mica
1" " .001 "
3/4" " .001 "
1/2" " .001 "
1/4" " .001 "

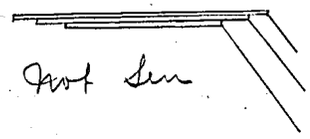
#3



1 5/8" dia .005 Mica
1 3/16 " .002 "
7/8 " .001½ "
5/8 " .003 "

Not Sen.

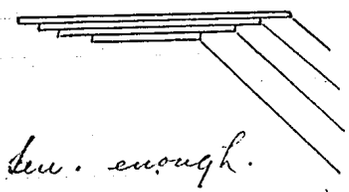
#4



1 5/8" dia. .005 Mica
1 1/16 " .002 "
7/16 " .003 "

Not Sen

#5

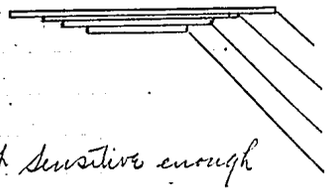


1 5/8 dia .006 Iron
1" " .001½ Mica
3/4 " .001½ "
7/16 " .001½ "

Not Sen. enough.

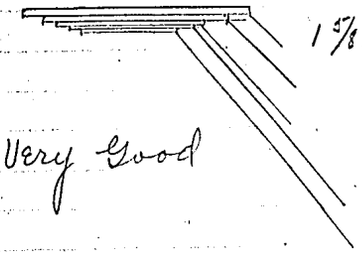
#33

Oct 1920



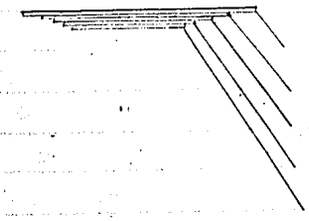
1 5/8" dia .005 Iron
1" " .002 Mica
3/4" " .001 " "
3/8" " .001 " "

Not sensitive enough



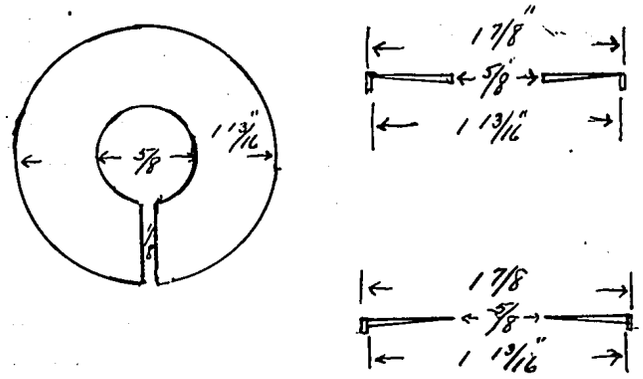
1 5/8 dia .002 mica
.004 Glass
.001 Mica
~~.001~~ "
.001 "
.001 "

Very Good



1 5/8 dia .002 mica
.003 Glass
.001 Mica
.001 "
.001 "

35 October 1920

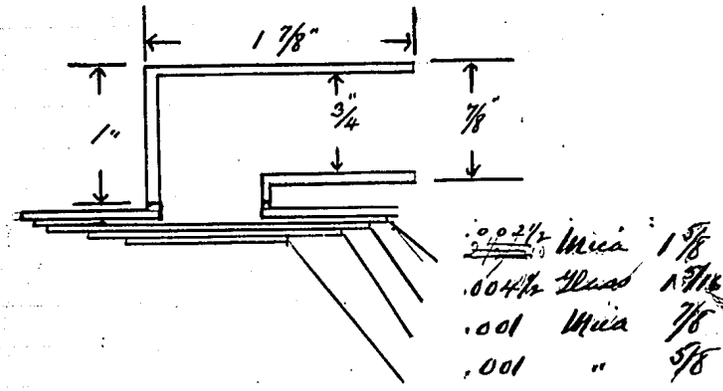


1/32 Brass Stock

Tapered from 1/32 to a knife edge

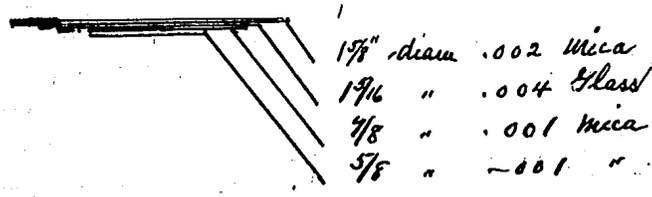
Oct 1920

#21 Recorder.



Very Good.
Good tone + holds well.

#22 Recorder
Same dimensions as #21 in metal parts, but first layer of mica is ½ thousand thinner



39 October 1920

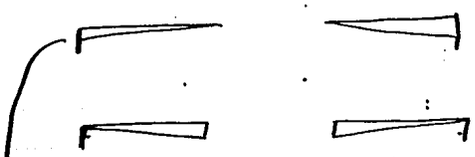
Started experiments with large diaphragm with air chamber for cushioning, as near as I could measure 1/16" diameter. These trials showed rather sensitive.

I now tried at Mr E. request a 1/32" and a 1/64 air chamber and results were much better

Mr E. said very good better than standard

Now try plates, tapering from 1/32 to a knife edge, both from center to outside, and from outside to centre.

Good.



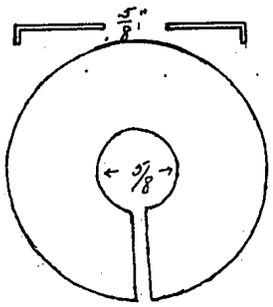
Louder than straight plate placed as near as possible to diaphragm, say about 1/64"

Thinner and spotty compared with above plate.

Must show M.E.

43 October 1920

1st trial plate



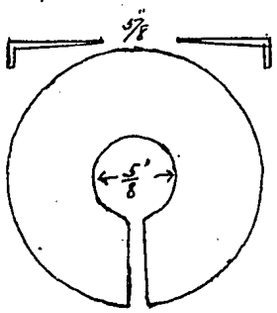
This plate is placed as near to the diaphragm as possible in Jack pick clearing

Mr E says "a little weak"

45

October 1920

2nd Trial plate



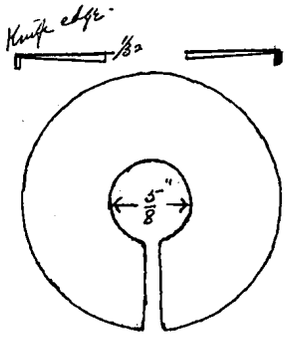
This plate tapers from the outside 1/32" to a knife edge centre, ~~and~~

Mr E says "Louder than # 1 plate
Page # 43

47

October 1920

3rd trial plate



This plate tapers from 1/32" centre to a knife edge on outside.

~~Mr E. Lago little weaker than #2~~
~~Try more sensitive diaphragm~~

Page #45

49

October 29th 1920

1st trial plate with 5/8" hole in centre tapering from 1/32 on outside to knife edge, and the air space between diaphragm and plate on edge of plate (outside) is about 1/64".

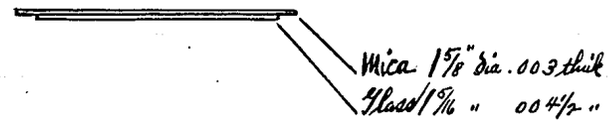
2nd trial, same plate as #1 but centre hole reduced from 5/8" to 1/4"

3rd trial, same plate as #1 & #2 centre hole reduced to 1/16"

51

November 1920

Made up 2 new diaphragms of following dimensions



These diaphragms when placed in recorders with 3/4" openings were entirely too sensitive so I tried different size plates for cushioning on outside, as well as inside

53

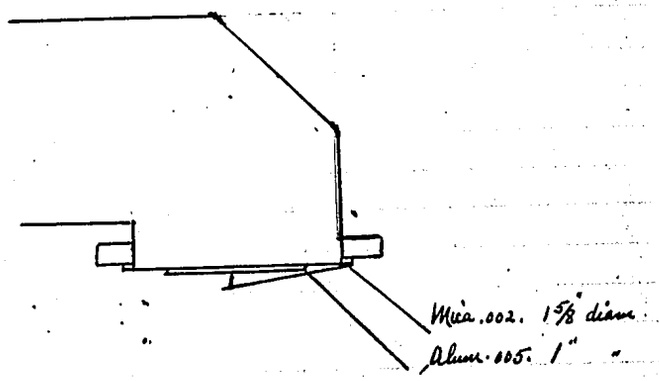
November 1920

Plate with 5/8" hole in centre and tapering from 1/32" to knife edge centre (See page 45) gave such good results I now make 3 plates with 11/16" — 3/4" and 7/8" centre holes

I find that machinist has made above plates 1/8" too large, inside diameter, and in order to overcome this, I put a rubber gasket in each plate.

54.

Diaphragm #1 Large Recorder.



#55

Using Dia #1 Large November 1920

Try Plate with 1/4" centre taper 1/32" to knife

Result: Little muffled and mate

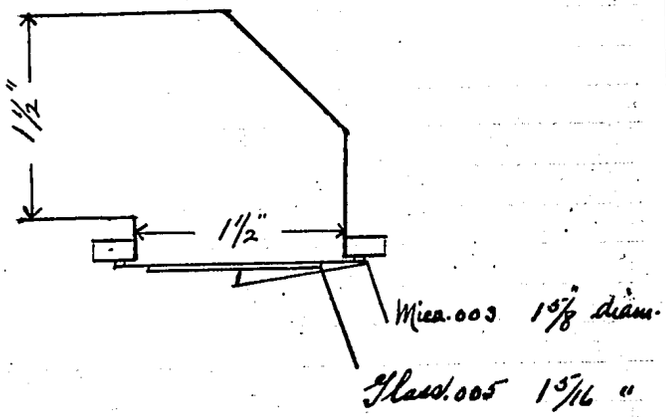
Try plate with 5/8" centre taper 1/32" to knife edge
Result: Better than 1/4" centre but could be louder

Try plate with 11/16" centre taper 1/32 to knife edge
Result: no louder than 5/8" centre and if anything trifle thinner

Try plate with 3/4" centre taper 1/32 to knife edge
Result: About same strength as 11/16 centre but little sharper.

I think 5/8" hole in centre of plate gives best results

Recorder #2. Large.



November 1920

New Recorder call it #2 large.

Diaphragm .003 Mica 1 5/8" in diameter
.005 Glass 1 5/16" " "

Using Recorder #1 made following experiments

1st. Piano 9 feet from horn

Plate with centre opening 1/4" Air space between the plate and the diaphragm is 1/32" Solid good tone but must be louder

2nd Plate with centre opening 3/8" Air space same as above. 1/32"

Result: Not much difference between 1/4" + 3/8" opening

3rd. Plate with centre opening 1/2" Air space same as above. 1/32"

Result: Little louder than 1/4" and 3/8" opening and still retains good solid quality

Using Recorder #1

4th Experiment
Plate with centre opening 5/8"
Air space same as #3 1/32"
Result: Little louder than #5 experiment otherwise no difference

5th. Plate with centre opening 3/4"
Air space same as above
Result: Sharper than #4 and little weaker

6th Plate with centre opening 7/8"
Air space same as above.
Result: Sharp and lost tone

Using Recorder #2.

1st Plate with 1/4" hole in centre
Air space 1/32" between plate & Diaph.
Result. Somewhat muffled

2nd Plate with 3/8" hole in centre
- Air space same as above 1/32"
Result: Better than # 1 but still a little muffled

3rd. Plate with 1/2" hole in centre.
Air space same as above 1/32"
Result: Better than # 2 - clearer and louder.

4th Plate with 5/8" hole in centre
Air space same as above 1/32"
Result: Best so far, louder & more ring than above experiments

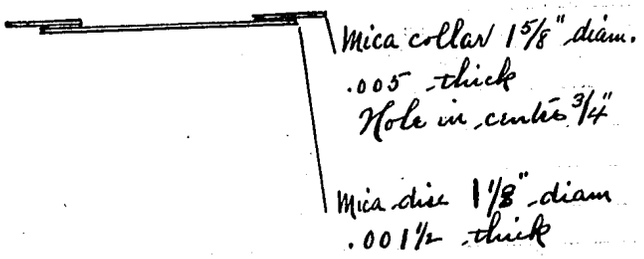
Diaphragm in #21 is of the following dimensions

This recorder has an opening of 3/4" and I am using plates for cushioning on outside as well as inside.

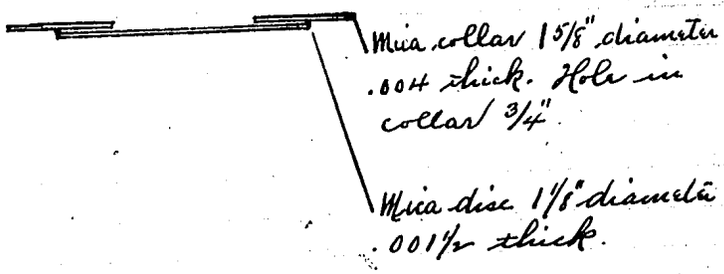
Made trial by piano, fitted with plate 3/4" opening in centre and 1/32" between plate & diaphragm and while results were very good, I thought the low notes were just a little too loud and I put plate with 7/8" opening and this gave me a much better balance.

It seems that a 1" diaphragm will turn out very good, and I

Made 2 diaphragms following dimensions

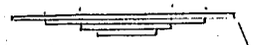


Collar + disc are put to-gether with stratina.



will now try out all plates in order to ascertain exact effect of each.

In all experiments the 5/8" hole in centre seems to be the best. This being the case I decide to stick to this diameter when making trials of different size air cushions for Mr E.

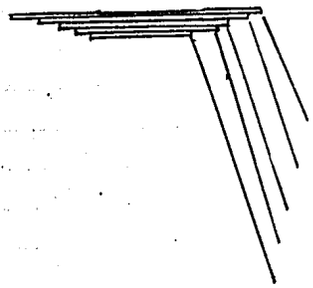


#3 Recorder

Mica 1 5/8" diam. .003 1/2
" 1 1/8 " .002 1/2
" 5/8 " .002
" 1/4 " .001.

Solid but not loud enough

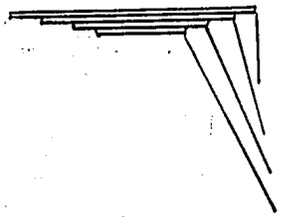
#2 Recorder



Mica 1 5/8 diam .003
" 1 1/4 " .002 1/2
" 7/8 " .002
" 1/2 " .001 1/2
" 1/4 " .001 1/2

Spotty and not loud enough

#1 Recorder

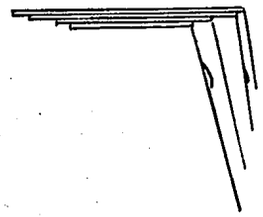


Mica 1 5/8" diam .003
" 1 1/8 " .002 1/2
" 5/8 " .002
" 1/4 " .001

Pretty good but could be louder

December 1920

4 Recorder



Mica	1 5/8	diam	.001 1/2
"	1 1/8	"	.002
"	3/4	"	.002 1/2
"	1/2	"	.003

Not sensitive enough.

Made up again	Mica	1 5/8	diameter	.003
	"	1 1/8	"	.001
N. G. Remade		3/4	"	.001
Dec 11 1920		3/8	"	.001

Better than above but could be louder if piano is O.K. Used new Lauter Piano

2 Recorder remade.

Mica	1 5/8	diameter	.003 thick
"	1 1/8	"	.003 "
"	3/4	"	.002 "

Very good in fact best results to date but I still think should be louder.

Made trials .075 - .060 - .045 - .030 for Mr E -

December 1920

4 Recorder Laminated

Mica Diameter 19/16. thickness .002½
" " 1 1/8. " .002
" " 15/16. " .002

Seems very good, loud, good tone but might be trifle too sensitive for piano
Made trials .075-.060-.045-.030 for Mr. E.

#5. Recorder Laminated

mica Collar 19/16 — .003
Hole in centre 5/8"
Next Mica piece 1 1/8" — .002
" " " 5/8 — .002
Made trials .075-.060-.045-.030 for Mr. E.
Solid and good tone but still think it must be thinner.

Remade. but as diaph. seemed good I have put same in small wooden box in chest so that I can put it back if necessary.

#1 Recorder

Mica collar	Outside diameter	1 5/8"
1st Lam.	Hole in centre	7/8"
	Thickness	.004

Mica collar	Outside diameter	1 1/4"
2nd Lamination	Hole in centre	1/2"
	Thickness	.003½

Mica Disc	Outside diameter	3/4"
	Thickness	.002½

Above ~~Too weak~~. made up again

#1 Recorder. Remade

Mica Collar	Outside diameter	1 5/8"
	Hole in centre	1/2"
1st lamination	Thickness	.002½

Mica Disc	Outside diameter	1 1/8"
	Thickness	.003

Second Lamination

December 1820

#3 Recorder.

Mica collar, outside diameter 1 5/8

(1st Lamination) → Thickness .002½

Hole in centre 5/8"

Aluminum disc, outside diameter 1 1/8

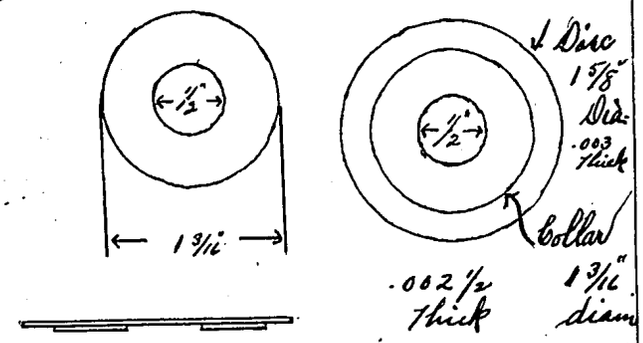
Thickness .005

 December 17 1920

New diaphragm in #5 Recorder

Mica 1 5/8" diameter .003 thick

Mica Collar 1 3/16" outside diam. .002½ "
Hole in center ½" diameter



This collar is fastened to mica disc .003 thick 1 5/8" in diameter with rubber cement, and in placing the diaph. on rubber gasket the collar is facing opposite side to the cushioning plate, and the whole is fastened to recorder form with bees wax and rosin.

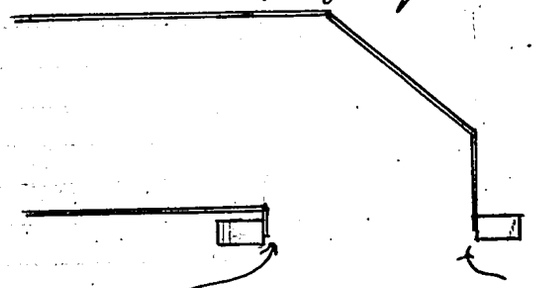
80

81

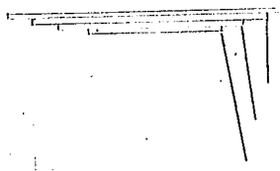
Dec 23 1920

Recorder #6

This recorder is made so that I can stand rubber gasket upon edge. So that I would not be compelled to alter plates any I had the thickness of the ring holding depth screw, and advance ball arm, made 1/32" more than others, and then this gives me room enough for gasket to set on.



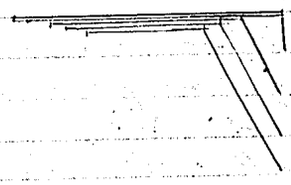
Recess for Gasket.



Mica 19/16 — .002
" 1 1/4" — .001 1/2
" 7/8 — .002 1/2
" 1/2 — .002 1/2

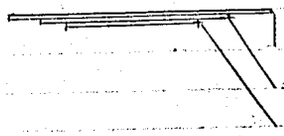
Dec 24 1920

1



Mica 1 9/16 – .001½
" 1 3/8 – .001½
" 1 9/16 – .002
" 1 – .002

2

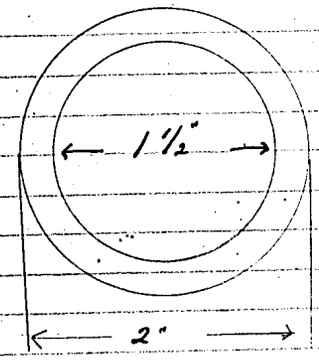


Mica 1 5/16 – .001½
" 1 1/8 – .002
" 15/16 – .002

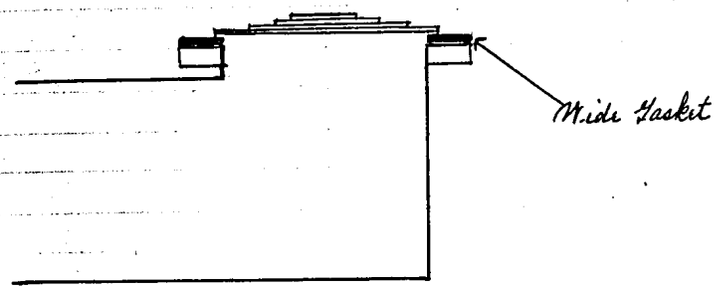
3 Same as above – all 3 stuck wax stratima

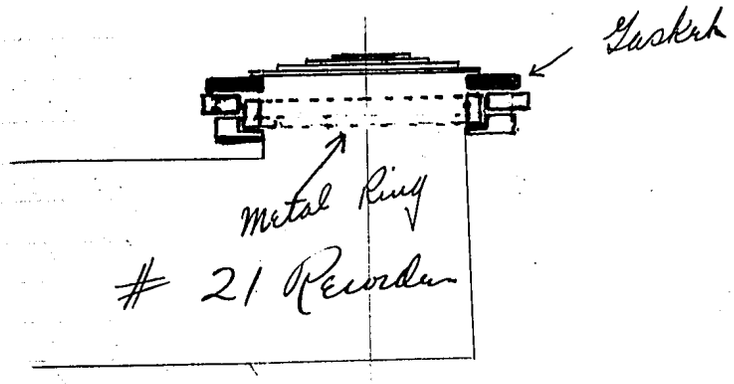
Dec 24 1920

Mr Edison says that small gasket is too narrow and naturally gives diaphragm a side motion therefore making cut rougher than it should be. He suggests we try a much wider rubber gasket of different thicknesses.



1/32" thick
1/16 "
1/8 "


Wide Gasket

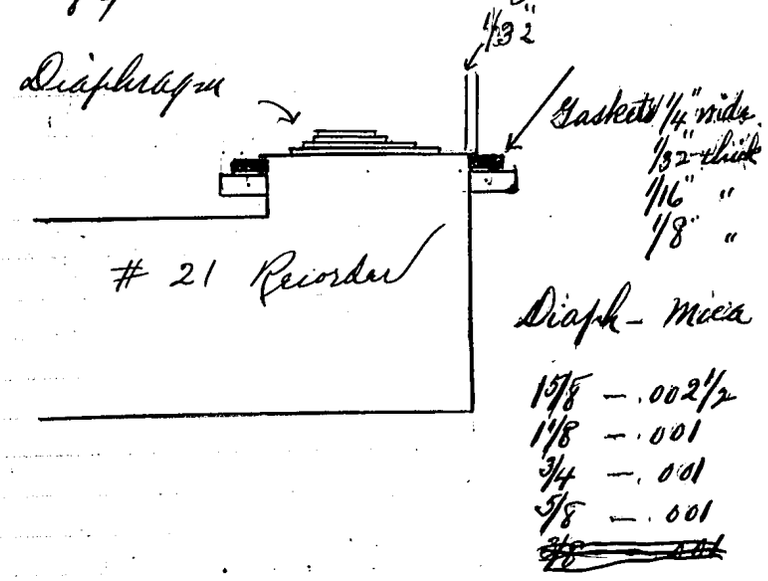


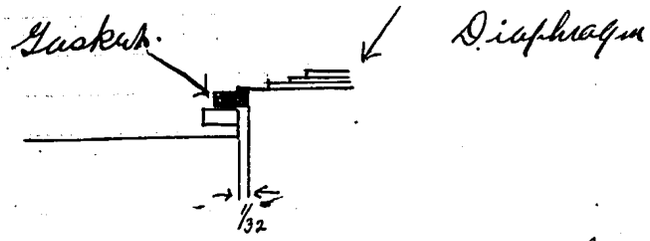
I had 3 different rings made in order to be able to get an over hang of the gasket of different measurements.

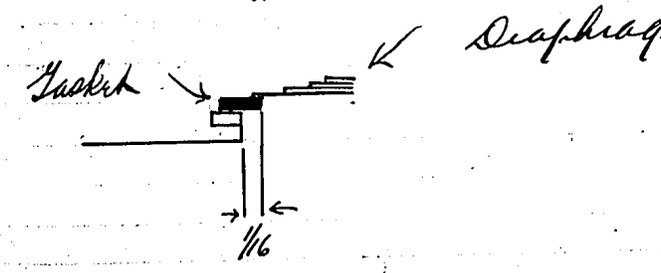
The first gives me over hang of 1/32". the 2nd 1/16" and then with all out I get 1/8" overhang.

I find that the overhang of a gasket did not influence the tone to any extent, but the greater the overhang the more sensitive the diaphragm also the more sluggish.
Mr Edison picked out the trial of 1/16 overhang as being the best and instructed me to duplicate this recorder and then put same away and keep it as a standard.
I duplicated #21 recorder and then showed Mr E. the trials and he said they were exactly alike so I have both #20 and 21 locked in box as standards. They are both mica diaph. regnd. Measurements on page #89

Jan 1921







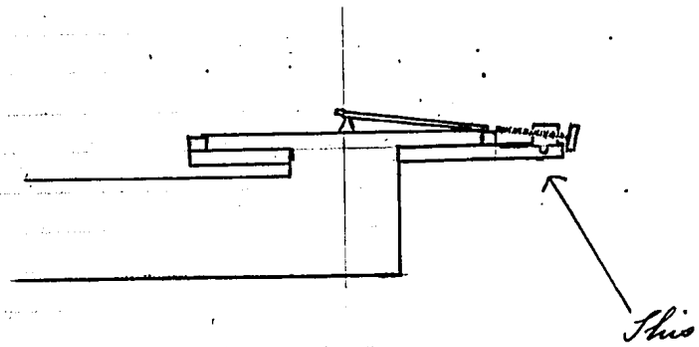
Mr E. says we must find the proper angle upon which the needle must cut the wax and to do this we must start on what we will say "scraping" considerably and then gradually raise the blank by means of thin "pads" taking a cut each time until we find the angle giving the smoothest cut.

Diaphragm #3 cuts on an angle of 12 degrees and is 3/16" high. (3/16" 12 degrees)

I started at the lowest hurling point that it is possible to cut cleanly and made 14 cuts changing 2 degrees each cut but as the leeway between the blank and the advance ball arm is so small that there is very little if any difference in roughness.

Mr E. says to try a brace on the end of the recording needle arm as he thinks that when bucking the cross it has a backward and forward motion causing a chatter also a certain degree of roughness

I will make the following as per Mr E. instructions

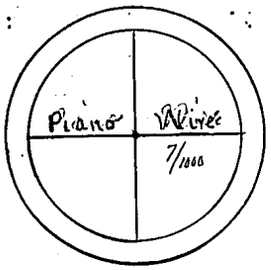


attachment is a brace to put pressure on the recording arm and Mr E. claims that it should control the blubber in same manner as the cross also help perhaps the obtaining of smoother cuts.

94

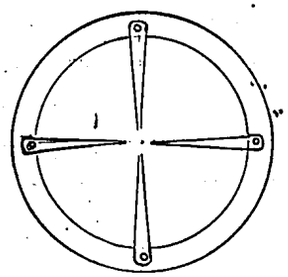
95 Jan 1921

Tried following control of diaphragm



Very Good.

Wire adjustable with screw and nut. Small Arrow used to tighten nut.

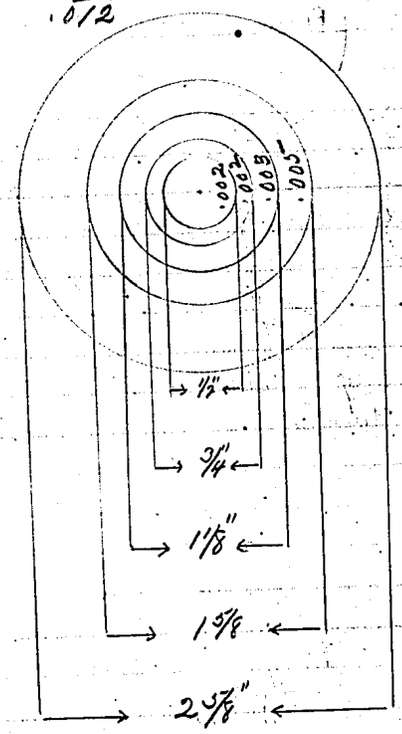


Spring Steel

N. G.

New Die made by Hayes

1 5/8" — .005
1 1/8" — .003 ..... # 2
3/4" — .002
1/2" — .002
.012



.012 in Centre

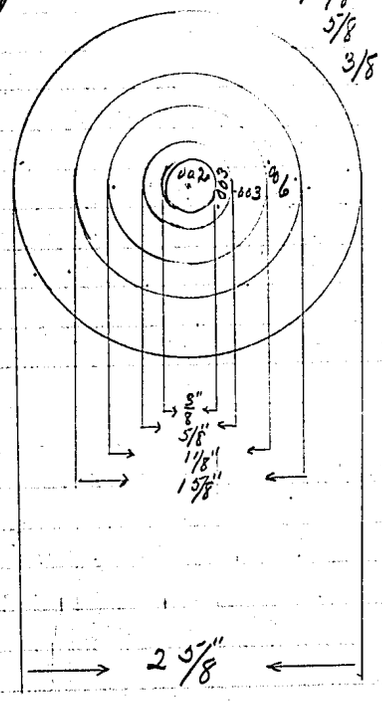
Feb 4th 1921

Made up at Mr E. request a duplicate of #21 recorder and he found it (#20) exactly same no blurring but a little weaker than paper die.

1

1 5/8 — .006
1 1/8 — .003
5/8 — .003
3/8 — .002
.014

.014 in centre



New Die made by Hayes

Feb. 1921

All pressed on Brady's Die
I now stack pressing paper
and shellac diaphragms
using 70 lb pressure and
heating with steam, cooling
with water. Press in old forge
and using die made by Brady.

#1 Diaphragm. 6 – 1 5/8 – 5 1/2 2 min.
Thinner than standard 3 – 1 1/8 8 1/2 70 lb.
3 – 7/8 14 1/2
3 – 5/8 16 3/4 Cold.
3 – 3/8 18 1/2

#2 Diaphragm 6 – 1 5/8 5 2 min
Very good tone 1 – 1 1/8 7 70 lb.
Holds well no control 1 – 7/8 12 1/2
Back on Vernus and 1 – 5/8 15 Cold.
Hayes recorders 1 – 3/8 16 1/2
Compares well with standard #20-21

3 Diaphragm 6 – 1 5/8 2 M.
4 – 1 1/8 70 lb.
N. Y. Bass. 3 – 7/8
N. Y. 2 – 5/8 Cold.
2 – 3/8

#4 Diaphragm 6 — 1 5/8 – 6 1 1/2 min
4 — 1 1/8 9 1/2
3 — 7/8 15 1/2 70 lb.
2 — 5/8 18 1/2
1 — 3/8 19 1/2 Cold.

#5 Diaphragm 7 — 1 5/8 5 1/2 2 min
Good tone holds fine but 1 — 1 1/8 8 ~~9 1/2~~
thinner than standard 1 — 7/8 14 70 lb.
Does not blub on F 5 1/2 ft 1 — 5/8 16 1/2
1 — 3/8 17 1/2 Cold.

#6 Diaphragm 7 — 1 5/8 – 5 1/4 4 min
2 — 1 1/8 8 70 lb.
2 — 7/8 14
3 — 3/8 16 1/2 Cold.
17 1/2

#7 Diaphragm 5 — 1 5/8 6 1 1/2 min
4 — 1 1/8 9 70 lb.
3 — 7/8 13 1/2
3 — 5/8 Cold.
2 — 3/8 17 1/4
19

#8 Diaphragm 5 — 1 5/8 – 6 1/2 1 1/2 min
4 — 1 1/8 9 1/2 70 lb.
3 — 7/8 13 1/2
2 — 5/8 18 Cold.
2 — 3/8 19 1/2

100 Feb 1921

#9 Diaphragm 5 — 1 5/8 6 1/4 1 1/2 Min.
4 — 1 1/8 10
3 — 7/8 15 3/4 70 lb.
2 — 5/8 18 1/2
1 — 3/8 19 3/4 Cold.

#10 Diaphragm 5 — 1 5/8 2 Min
Good tone loud - Blots on F 3 — 1 1/8
compares favorably with #21 standard 3 — 7/8 70 lb.
3 — 5/8
3 — 3/8 Cold.

#11 Diaphragm 5 — 1 5/8 - 5 1/2 2 Min
1 — 1 1/8 - 8 1/2 70 lb.
1 — 7/8 - 13 1/2
1 — 5/8 14 1/2 Cold.
1 — 3/8 16

#12 Diaphragm 4 — 1 5/8 5
Very good on Oboes 3 — ~~1 1/32~~ 1 09/32 8
Best - to date Feb 18th; 3 — ~~7/8~~ 15/16 13 1/2
good tone + holds well.
Good on Keys blots on F not 3 — 5/8 16 1/2
so full as #2 3 — 11/32 18 1/2

2 Min 70 lb.
Cold.

See pages 96-97 101 Feb 22 1921

New Dies made for Hayes #3

Diameter 1 5/8" Depth 7 — 7
" 1 1/4" " 1 — 8
" 1" " 1 — 9
" 3/4" " 1 — 10
" 1/2" " 1 — 11

#4 Die

Diameter 1 5/8" Depth 6 — 6
" 1 1/4" " 1 — 7
" 1" " 1 — 8
" 3/4" " 1 — 9
" 1/2" " 1 — 10

#5 Die

Diameter 1 5/8 Depth 5 — 5
" 1 1/8 " 3 — 8
" 3/4 " 2 — 10
" 1/2 " 1 — 11

Feb 25 1921

Hayes Die #1

#14 Diaphragm 1 5/8 – 5 – 5 Gasket 2 1/2" O.D.
1 1/8 – 3 – 8 1/16 ~~[illegible]~~ 9/16 " "
3/4 – 2 – 10 Die reading 1/32"
1/2 – 2 – 12 Very arm and Blistering

#2 Die

#15 Diaphragm 1 5/8 – 6 – 6
1 1/8 – 3 – 9
5/8 – 3 – 12 1/2
3/8 – 2 – 15

#3 Die

#16 Diaphragm 1 5/8 – 7 – 7 1/2
1 1/4 – 1 – 9
1" – 1 – 10
3/4 – 1 – 11
1/2 – 1 – 12

#4 Die

#17 Diaphragm 1 5/8 – 6 – 6
1 1/4 – 1 – 7
1 – 1 – 8
3/4 – 1 – 9
1/2 – 1 – 10

#5 Die (1) – (2)

#18 Diaphragm 1 5/8 – 5 – 5 – 5 Seems to blist more than #14 Die
1 1/4 – 3 – 8 – 8
3/4 – 2 – 10 1/2 – 10
1/2 – 1 – 12 – 11 1/2

Feb 25 – 1921

Brady Die

(1) (2)

#19 Die. 1 5/8 – 4 = 1 5/8 – 5 1/2 5
1 1/4 – 5 = 1 9/32 – 8 1/2 – 8
7/8 – 3 = 13/16 – 14. – 13 1/2
21/32 – 16 1/2 – 16
11/32 18 1/2 – 18

#20 Diaphragm 1 5/8 – 3 = 1 5/8 – 5
1 1/4 – 6 = 1 9/32 – 8
7/8 – 3 = 15/16" – 13 1/2
21/32 – 15 1/2
11/32 – 17

#21 Diaphragm
1 5/8 – 3 = 1 5/8 – 4 1/2
1 1/4 – 7 = 1 9/32 – 8
7/8 – 3 = 15/16 – 14
21/32 – 16
11/32 – 17 1/2

#22 Diaphragm 1 5/8 – 3 = 1 5/8 – 5 1/2
1 1/4 – 8 = 1 9/32 – 8 1/2
7/8 – 3 = 15/16 – 14 1/2
21/32 – 17
11/32 – 19

Feb 25 1921

Brady Die

#23 Diaphragm
1 5/8 - 4 1/2
1 9/32 - 7 1/2
15/16 - 13 1/2
21/32 - 15
11/32 - 16

#24 Diaphragm
1 5/8 - 4 1/2
1 9/32 - 7 1/2
15/16 - 13 1/2
21/32 - 16
11/32 - 17 1/2

Hayes Die #6

#25 Diaphragm
1 5/8 - 4
1 7/16 - 6 1/2
1 3/8 - 8 1/2
1 - 9 1/2
3/4 - 10 1/2
1/2 - 12

Mica perforated .001 between 2 layers of paper on 4 5/8.

#26 Diaphragm
1 5/8 - 3
1 7/16 - 5 1/2
1 3/8 - 7
1 - 9
3/4 - 10
1/2 - 11 1/2

Hayes Die #7

#27 Diaphragm
1 5/8 - 2 1/2
1 7/16 - 5
1 ~~1/4~~ - 8
1 - 9 1/2
3/4 - 11
1/2 - 12 1/2

Brady Die

#28 Diaph.
1 5/8 - 3 1/2
1 9/32 - 7
15/16 - 12 1/2
21/32 - 13
11/32 - 14

#29 Diaph.
1 5/8 - 4 1/2
1 9/32 - 7 1/2
15/16 - 13
21/32 - 14
11/32 - 15

#30 Diaph.
1 5/8 - 2 1/2
1 9/32 - 5 1/2
15/16 - 11 1/2
21/32 - ~~11 1/2~~
11/32 - 11 1/2

March 5th 1921

106

Hayes Die #10 — Draft #31

Better than #14 & 18 less Blue

1 5/8" - .005" - .005"
1 3/8" - .003 - .008
3/4" - .002 - .010
1/2" - .002 - .012

Hayes Die #8 — Draft #32

1 5/8 - .003 - .003
1 7/16 - .001 - .004
1 5/16 - .001 - .005
1 3/16 - .001 - .006
1 1/16 - .001 - .007
15/16 - .001 - .008
13/16 - .001 - .009
11/16 - .001 - .010
9/16 - .001 - .011
7/16 - .001 - .012

Hayes Die #9 — Draft #33

1 5/8 - .003 - .004
1 7/16 - .001 - .005
1 5/16 - .001 - .006
1 3/16 - .001 - .007
1 1/16 - .001 - .008
15/16 - .001 - .009
13/16 - .001 - .010
11/16 - .001 - .011
9/16 - .001 - .012
7/16 - .001 - .013

March 5th 1921

107

Hayes Die #1 — Draft #34

1 5/8 - .001 Mica .004 Paper
1 1/8 .003 "
3/4 .002 "
1/2 .002 "

Draft #35

Hayes Die #5

1 5/8 - .001 Mica .004 Paper
1 1/4 .003 "
3/4 .002 "
1/2 .001 "

Hayes Die #11 — Draft #36

1 5/8 - .001 Mica .004 Paper
1 1/4 .003 "
7/8 .003 "
5/8 .001

Draft #37

Hayes Die #12

1 5/8" - .005" - .005
1 3/8" - .003 - .008
1" - .002 - .010
1/2 - .002 - .012

Hayes Die #13 — Draft #38

1 5/8" - .005" - .005"
1 3/8" - .003 - .008
1 1/8" - .002 - .010
1/2" - .002 - .012

Mar. 7th 1921

Hayes Die # 14 — Diaph # 39

1 5/8" – .005 – .006
1 3/8" – .003 – .008
1 1/8" – .002 – .010
3/4" – .002 – .012

Hayes Die # 15 — Diaph # 40

1 5/8" – .005 – .006
1 3/8" – .003 – .008
1 1/8" – .002 – .010
7/8" – .002 – .012

Hayes Die # 1 — Diaph # 41

1 5/8" – .003 – .003 hard to fit
1 1/8" – .003 – .006
3/4" – .002 – .008
1/2" – .002 – .010

Hayes Die # 16 — Diaph # 42

Very good holds best of all.

1 5/8" – .005 – .006
1 3/8" – .003 – .008
1 1/8" – .002 – .010
7/8" – .002 – .012
5/8 – .002 – .014

Hayes Die (Mr E.) #17 — Diaph # 43

1 5/8" – .001 – .001 1/2
1 3/8" – .002 – .003 1/2
1 1/8" – .005 – .008 1/2
7/8" – .002 – .010 1/2

Hayes Die # 18 (Mr E.)

1 5/8" – .001 – .001 1/2
1 3/8" – .003 – .004 1/2
1 1/8" – .003 – .007 1/2
7/8" – .007 – .014 1/2

Hayes Die # 19 (Mr E.)

1 5/8" – .001 – .001 1/2
1 1/8" – .002 – .003 1/2
5/8" – .005 – .008 1/2
3/8" – .002 – .010 1/2

Hayes Die # 20 (Mr E.)

1 5/8" .001 – .001 1/2
1 1/8" .003 – .004 1/2
5/8" .003 – .007 1/2
3/8" .007 – .014 1/2

Various diaphragms passed of combinations such as
Rubber + Paper (shellaced)
Aluminum + " "
Mica + Paper "
Steel Springs (flat) " "

In using Rubber (hard) + Paper I found that while they were a good tone, they were not sensitive enough due to the thickness of Hard Rubber, I therefore put in an order for various thicknesses and now await same.

To my way of thinking the Paper and Aluminum makes a very good combination but Mr E. did not endorse any so I drop it for time being

Mica + Paper promises great things and I have difficulty in making them sensitive enough although the Mica is only .001½

Hard Rub. + Paper.

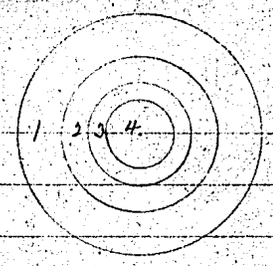
#1 Dia
1 5/8 – Hard Rubber .012
1 1/8 – Paper .003
3/4 – " .003
1/2 – " .002

#1 Dia
Aluminum + Paper
1 5/8 – Paper .005
1 1/8 – Alum. .001½
Paper " .002
3/4 – " .003
1/2 – " .002

#1 Dia
Mica + Paper
1 5/8 – Mica – .001½
1 1/8 – Paper – .003
3/4 – " – .003
1/2 – " – .002

19 - Dia
1 5/8 – Paper – .002 Springs .006
1 1/8 – " – .002
5/8 – " – .005
3/8 – " – .002

(#1)



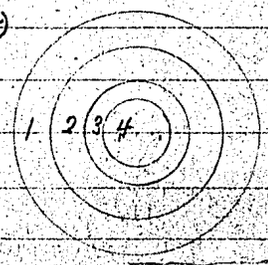
Drum Thickness

1 — 1 5/8" — .005
2 — 1 1/8" — .003
3 — 3/4" — .002
4 — 1/2" — .002
.012 Total centre

1

Blue but good bullets

(#3)

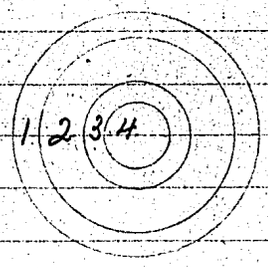


1 — 1 5/8" — .005
2 — 1 1/4" — .003
3 — 3/4" — .002
4 — 1/2" — .002
.012 Total centre.

2

Weaker - only little blue

(#10)

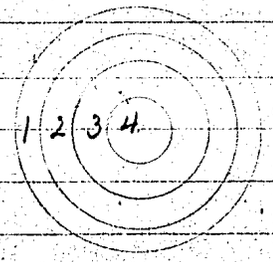


1 — 1 5/8" — .005
2 — 1 3/8" — .003
3 — 3/4" — .002
4 — 1/2" — .002
.012 Total centre

3

Bullets but not so good as No 1

(#12)

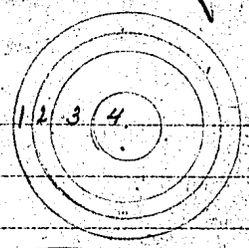


1 — 1 5/8" — .005
2 — 1 3/8" — .003
3 — 1" — .002
4 — 1/2" — .002
.012 Total centre

4

About same as 3 but blue bad

(#13) Original Carbon on Die - some wore than others

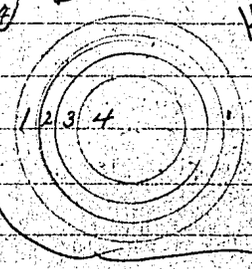


5

		Diameter	Thickness
1	—	1 5/8" —	.005
2	—	1 3/8" —	.003
3	—	1 1/8" —	.002
4	—	1/2" —	.002
			.012 Centre

Fairly level blade at end bad

(#14) Die 39 Keep this

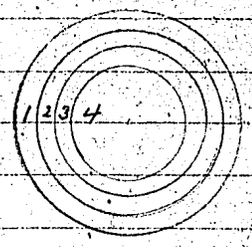


6

1	—	1 5/8" —	.005
2	—	1 3/8" —	.003
3	—	1 1/8" —	.002
4	—	3/4" —	.002
			.012 Centre

Looks very much cleaned Clean 5 - good grading 1/2 Blade

(#15)

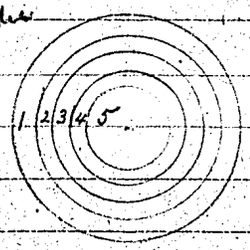


7

1	—	1 5/8" —	.005
2	—	1 3/8" —	.003
3	—	1 1/8" —	.002
4	—	7/8" —	.002
			.012 Centre

Looks like 6 but not so much as perfect. Clean + perfect slight trace of Blade

(16) die



1	—	1 5/8" —	.003
2	—	1 3/8" —	.003
3	—	1 1/8" —	.002
4	—	7/8" —	.002
5	—	5/8" —	.002
			.012 Centre

good grading

Best Very Bad Blade

$\frac{1}{8}$ —

001
002
005
040

001
003
006
015

$\frac{1}{4}$: another pair —

#1 .001 — 1 5/8" March 10th 1921
.002 — 1 3/8"
.005 — 1 1/8"
.010 — 7/8"

No blub
not loud

On this side
Steel springs pressed in paper

#2
.001 — 1 5/8"
Very much better & louder no Blubs
.003 — 1 3/8"
.006 — 1 1/8"
.015 — 7/8"

Blub louder than #1

#3
No better, but Blub only a little,
.001 — 1 5/8"
.002 — 1 1/8"
.005 — 5/8"
.010 — 3/8"

Very Bad Blub (Louder than 2 = Quality good)

#4
Quality good so good not so loud, no blub, not so bad as #2 or #3
.001 — 1 5/8"
.003 — 1 1/8"
.006 — 5/8"
.015 — 3/8"

All blub
No good too demonstration

10 Cork on Back of diaphragm

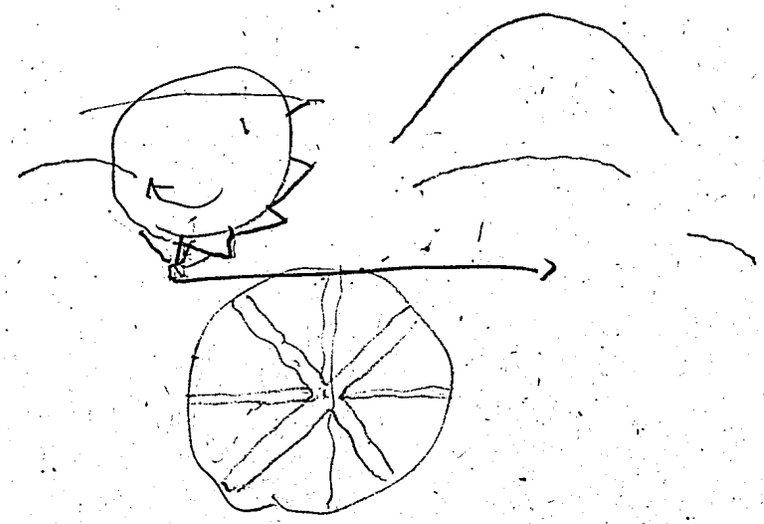
2nd Blank. Feb 26th 1921

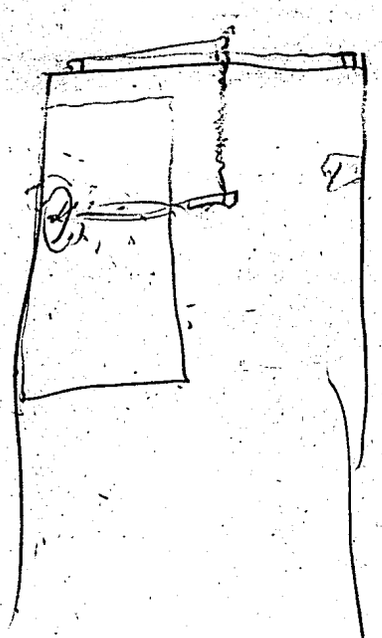
#1 #19 Die MV E. Dimensions

1 5/8" — .001
1 1/8" — .002
5/8" — .005
3/8" — .010
With steel (flat) spring

#2 #20 Die

1 5/8" — .001
1 1/8" — .003
5/8" — .006
3/8" — .015
With Spring





Filt 26 ~~A~~
1921

#1 1 5/8" — .004
1 1/8" — .003 Aluminum
~~.001 Paper~~

Oct 26th 1921

#1 1 5/8" — .004
1 1/8" — .003 Aluminum
.001 Paper
3/4" — .002 "
1/2" — .002 "

#2 1 5/8" — .004
1 1/8" — .002 Aluminum
3/4" — .002 Paper
1/2" — .002 "

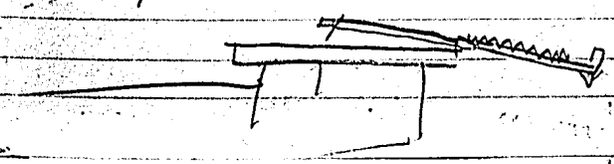
#3 1 5/8" — .001
1 1/8" — .003
5/8" — .006
3/8" — .015
~~Cork on~~ Back of diaphragm

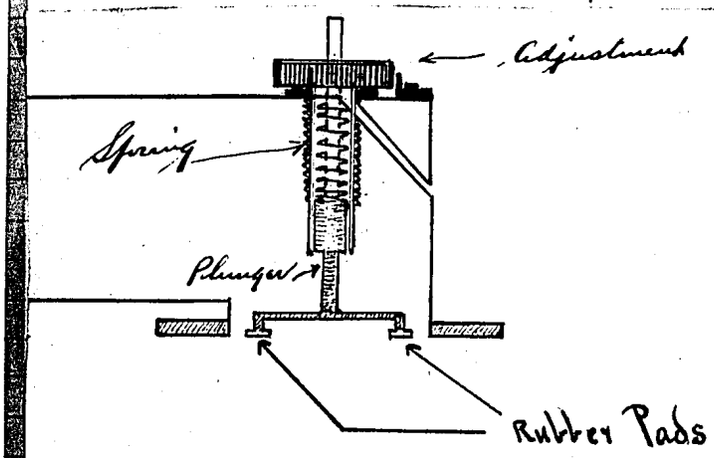
March 11th 1921

Have order Spring steel 1 3/4" wide and .003
.004
.005
.006
.007
.008
.009
.010 in thickness.

The object is to ascertain which shape and thickness is the most suitable and gives the best results in recording, as the experiments already made show that the steel is very fast and stops the "blurb" to a great extent even on .001 paper.

Recorder with brace on arm tends to make less sew and stops vibration

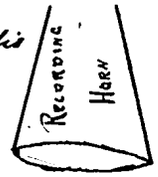




I had 3 Plungers made 1 with only one pad touching center of diaphragm 1 with 2 pads as above and 1 " 4 " the two and 4 pads touch diaphragm 1 1/8" line

116

Columbia St Studio



SET NO 10A

QUARTETTE

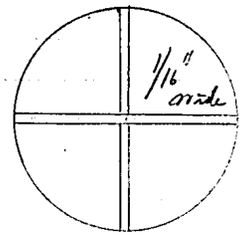
July 13 1921

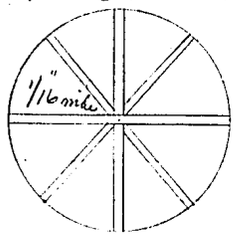
6ft	4ft	2ft		2ft	4ft	6ft
			1			
			2			
			3			
			4			
			5	FLUTE		
			6			
		CELLO	7			
			8			
			9			
			10			
		VIOLIN	11			
			12			
			13			
			14			
			15			
			16		BASSOON	
		HARP	17			
			18			

W. A. HAYES

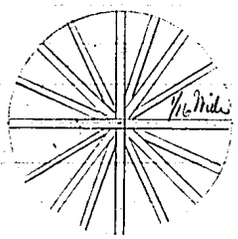
March 14. 1921

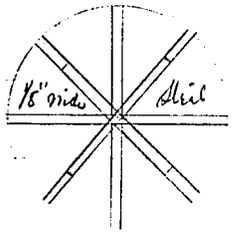
Made up the following shapes in .004 — .005 — .006 — .010 Steel



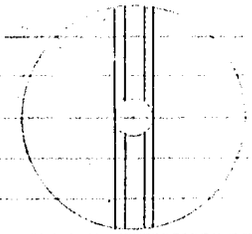


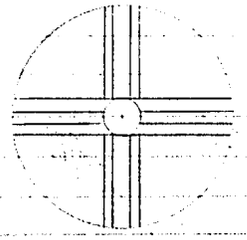
Made arms in different widths 1/16" - 1/8" - 3/16"

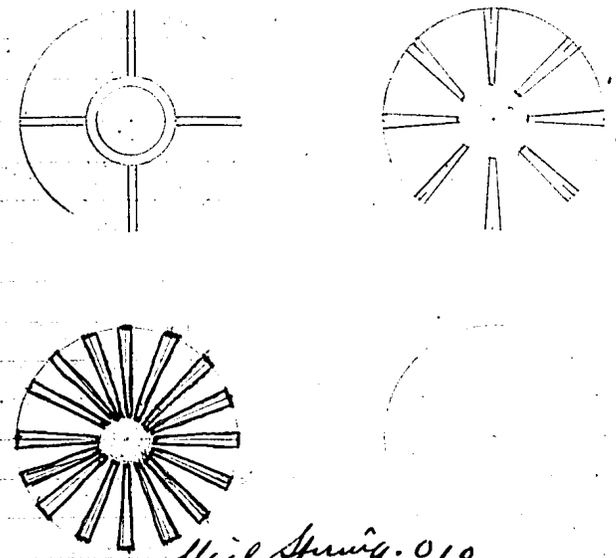




Made arms in widths of 1/16" - 1/8" - 3/16"





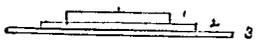


Steel Spring .010

4 different sizes that is in length but taper remains same in all
3/4" – 5/8" – 1/2 – 3/8"
taper from 1/8" to 1/16

 March 26th 1921

Started pressing the paper and steel diaphragms using #1 Die cutting the .002 - 1/2" out with a mica disc so that it would really read as follows.



Paper 1 - .002 - 3/4"
" 2 - .003 - 1 1/8"
" 3 - .002 - 1 5/8"
Steel .004 thick

Made with steel 4 points + 1/16" wide
1/8" wide + 3/16" wide

Made with 8 points ✳ 1/16" - 1/8" - 3/16" wide
" " 16 " ✺ 1/16" wide

Finished above and left to season for a few days

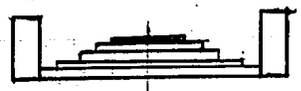
April 1st 1921

Tried out steel and paper .004 Steel
2nd
#1 Die as per page #117.

Sounds loud and good quality but "thuds" on all shapes of steel except 8 point 1/8" oxide and to my way of thinking this is not loud enough nor bright enough.

New Die called X Die

This Die is made contrary to Die already cut in as much as the centre is the thinnest part and this in my opinion should add to quality of diaphragm



Die X

1/2" - .003 - .003		1/2"
3/4" - .001 - .004		3/4"
1" - .001 - .005		1"
1 3/8" - .001 - .006		1 3/8"
~~1 5/8" - .00~~		1 5/8"

April 4th 1921

Made up recorders of .005 Steel and paper Shellac Die #1 shaped as per page # 117

April 5th 1921

tried out above and found all except 8 points 1/8" "Blue" somewhat but quality is good and strength seemed O.K.

April 6th 1921

As Steel seemed to work out so well I now have some cut 2" diameter 8 points 1/8" wide and pressed with paper shellac 2 1/8" diameter .008 – .010 – .015 thick to be use in Disc Reproducer.

April 7th 1921

tried above in reproducer and found them excellent tone, loud and hold everything much better than present diaphragm-paper & Cork.

The .015 thickness seems bad and I will now use .010 steel and .010 + .012 Paper of course crib out cork.

Had a new die made for pressing Reproducing diaphragms
2 1/8 — .012
1 5/8 — .003
1 1/8 — .002
5/8 — .001

I now cut the steel with 8 point 1/8 wide and 1 5/8 in diameter centre 3/16 to 1/4" and .010 thick

This gives me a very loud and full tone reproduction and holds true.
I tried it on Jazz record that rattles and blubbers on regular and results are great.

April 8th 1921
Made up recording .010 steel #1 Die as per shape Page #117

April 11th 1921
Tried out 4 point .010 steel and found no blub — loud — & good tone

June 5 1921

A.M. Sharing experimental machine
Blanks for Mr E. (Hand)
Blanks N.G. all out of shape
and full of air holes.

P.M. Made trials of sensitive
recorder. Brass .004 spring
1/32 wide pressed in paper.

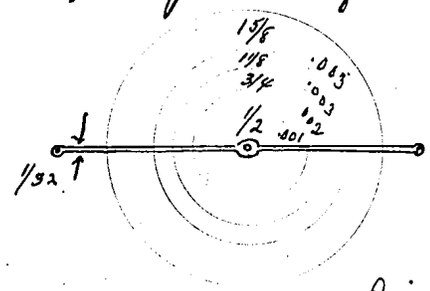
1 5/8	- .002
1 3/8	- .002
1"	- 002
3/4"	- 001
1/2	- 001
	.008

and controlled with screws on
each side.

Heard Reed "Air Mail"
Spaulding for source of sound
and found low tones quite
loud but notes in high
register weak. In fact results
are not satisfactory and
must get louder and more
even recorder.

June 9 1921

Made new recorder with .004 spring steel pressed into diaphragm and same pulled tight by means of screw



Dia .009 centre

1 5/8	—	.003
1 1/8	—	.003
3/4	—	.002
1/2	—	.001
		009

Results good in fact best I have had for loudness and evenness.

Trials made at 6 feet

June 10 1921

Making Condensite papers and pressing same for recorders.

June 11 1921

Made up new recorder and left same to set.

June 13 1921

Shaved blanks and tried out new recorder.

New recorder is made up of Condensite paper with .004 spring 1/32 in cradle pressed in but instead of being controlled by screws alone, I have inserted springs thinking that the latter will give somewhat and add quickness to diaphragm

Results are very good and even tried at back 6 - 8 feet.

C1335

June 14 1921

Worked on Electric Outfit. (Mr O.K.)

Made new springs for diaphragms

Werner using Recording Machine for duplicating

Shaved blank and recorded for Mr Edison (Geo Hart)

June 15 to July 13

Worked on new Disc recorder getting them as sensitive as possible so that we can work a distance away and still have record stand out.

July 13th 1921

Worked String Quartette but did not have time to really determine anything as Werner took up most of the morning balancing etc. Of course this was unavoidable coming to new conditions. Diaphragms etc. From the tests I did get, I saw that my diaphragms were a little too sensitive and must be made quicker and thinner

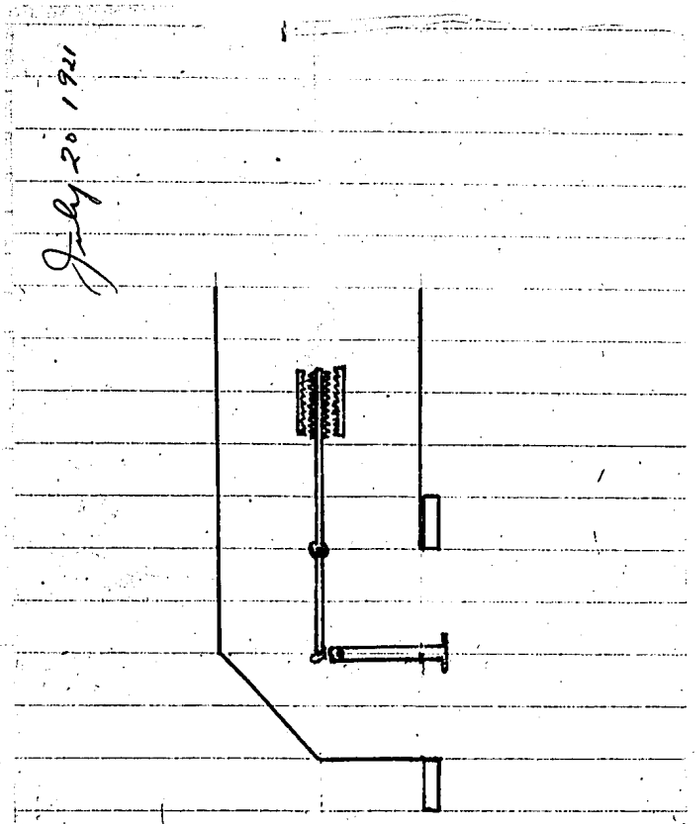
July 1921

I now try this Condensite diaphragm and I astern same to rubber gasket and Le Page Glue.

This experiment seems to bring out the voice much clearer and also comes out of the horn more than anything I have had up to date

July 20 1921

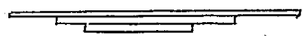
July 20 1921



[137]

Sept 7 1921.

Recorder #200



	1 5/8	— .005
Condensite	1 1/8	— .002
Rubber Gasket 1/16 wide 1/32 thick	3/4	— .001
held by glue		.008

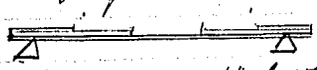
Recording arm 3/16" high
" " 7/8" long.
Hole in cap 5/8" diameter

Recorder #201

	1 7/8"	— .008	— 2
	1 1/4"	— .006	— 2
Condensite	1"	— .104	— 4

Rubber Gasket △ — 1/16
3/32

Dia 1 7/8" in diam - but working only on edges of gasket which is 1 1/2" diam

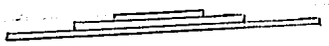


stuck with glue

Recording arm 3/16 high — 15/16 long
Hole in cap 5/8 diam.

Sept 1921

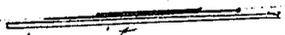
New Recorder #202



1 7/8" – .005"
1 1/8" – .001
3/4" – .001

Condensite
Gasket 1/16" – high
1/32 – thick
Recording arm 3/16 high – 15/16 long
Die – fastened to gasket with glue

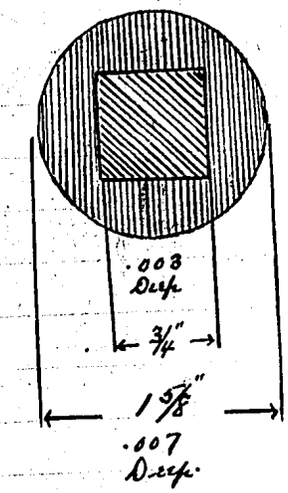
#203



1 5/8" – .005"
1 1/8" – .001
3/4 – .001

Condensite
Gasket 1/16 thick – 3/8" wide
Recording arm 3/16 high 15/16 long
Die fastened to gasket with glue

March 30 1922.



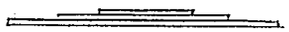
New die with square centre 3/4"

Dia. when finished is .007 thick outside of square centre
Square centre is .003 thick.

H. C. Hayes

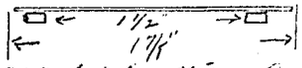
Sept 1921

#206



1 7/8" — .005 — 5
1 5/8 — .001 — 6
1" — .001 — 7

Gasket 1/8 wide 1/16 thick
Diaph - extends over the outside edges 1/16"



Arm 3/16" high - 15/16 long
Diaph - fastened to gasket with glue

Jan 27. 1921

Wax Master Blanks (Disc)

#1 – 150 parts Hard Wax
35 " Yellow Ceresine

2 – 150 parts Hard Wax (Rough)

3 – 150 parts Hard Wax (Rough)

4 – 150 parts Hard Wax (Rough)

5 – 150 parts Hard Wax
35 " Parafine (Rough)

6 – 150 parts Hard Wax
25 " Parafine (Rough)

7 – 150 parts Hard Wax
50 " Parafine (Rough)

8 – Same as #1 only chilled (Rough

10 – Same as #1 not chilled (Rough)

Feb. 1921

Wax Disc Master Blanks

#11 – 150 Parts Hard Wax
75 " Paraffine (Rough)

12 – 150 Parts Hard Wax
60 " Paraffine (Rough)

13 – 150 Parts Hard Wax
90 " Paraffine (Rough)

14 – 150 Parts Hard Wax
50 " Paraffine (Rough)

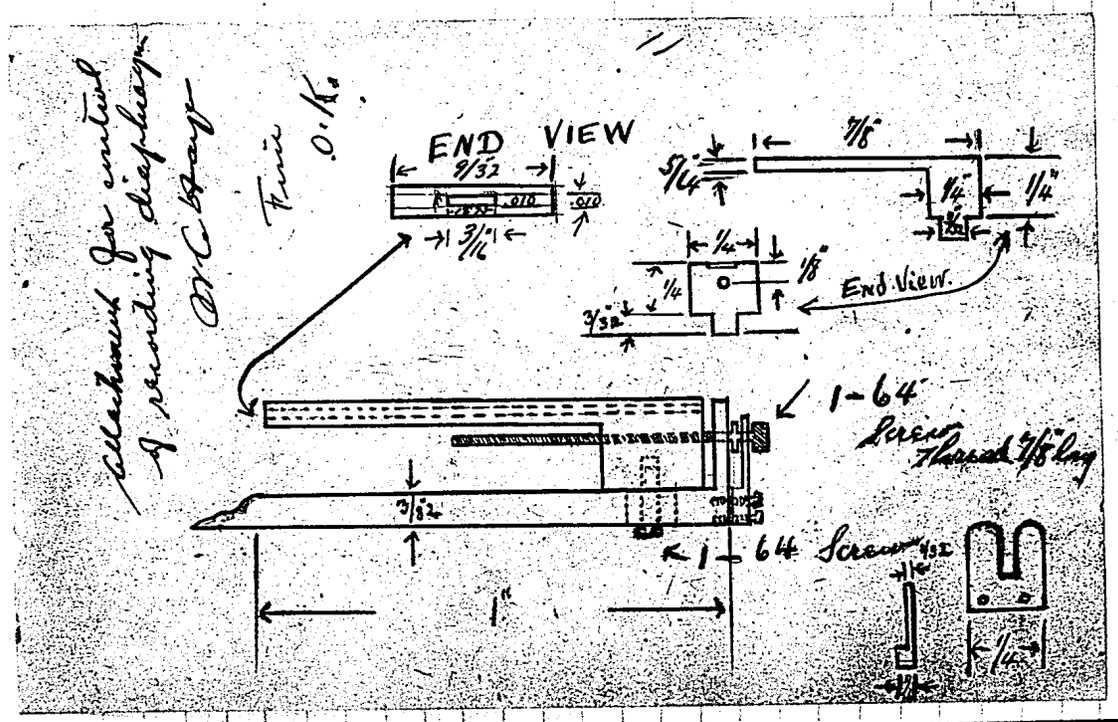
17 – 150 Parts Candellerie
8 " Salicylic Acid

Sept 13 1921

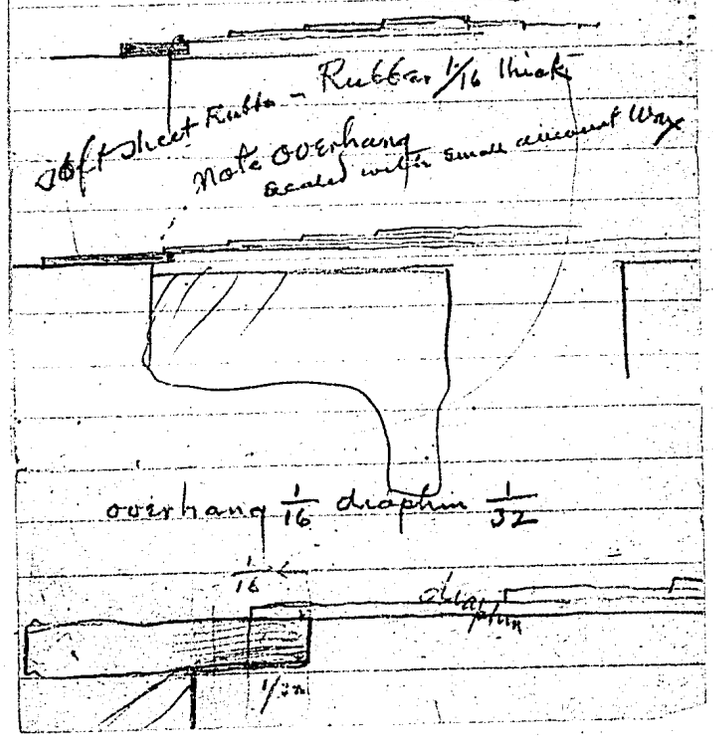
Made Piano record "Wedding of the Winds" Waltz played by Miss Ingrund.

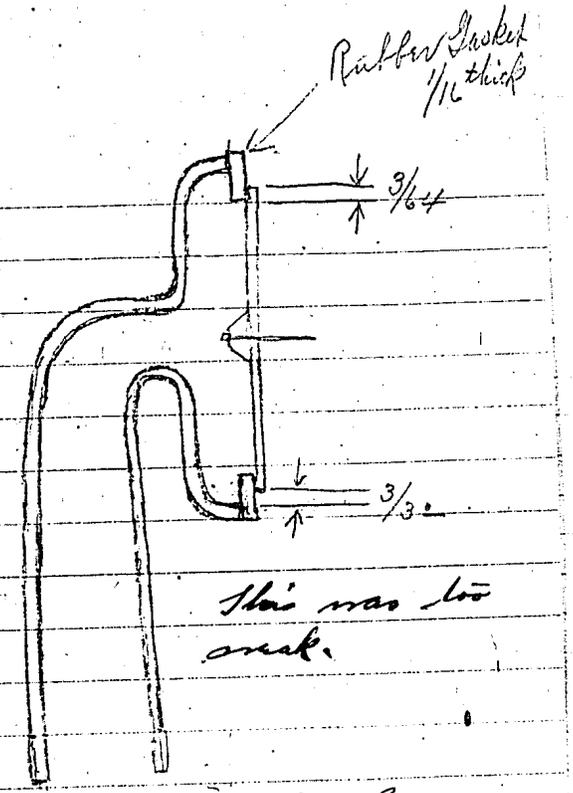
Recorder #201 – 5½ ft
" 205 – " "
" 201 – 6 "

Put them through plating etc and sent memo to Holsom to let one have prints so that I can show Mr E. when they come through. Mr Holsom says they will put them in baths on 14th inst.


Attachment for control
of sounding diaphragm
O.K.
END VIEW
9/32
.010
.010
3/16"
7/8"
5/4
1/4"
1/4"
1/4
1/8"
1/4
3/32
End View
1-64
Screw
Flattened 7/8" long
3/32
1-64 Screw
1"
1/4

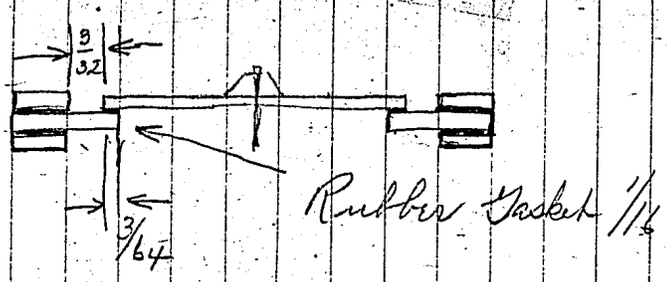
Hayes
Come & see me
on this —





This was too
small.

Mak up for Jm E.

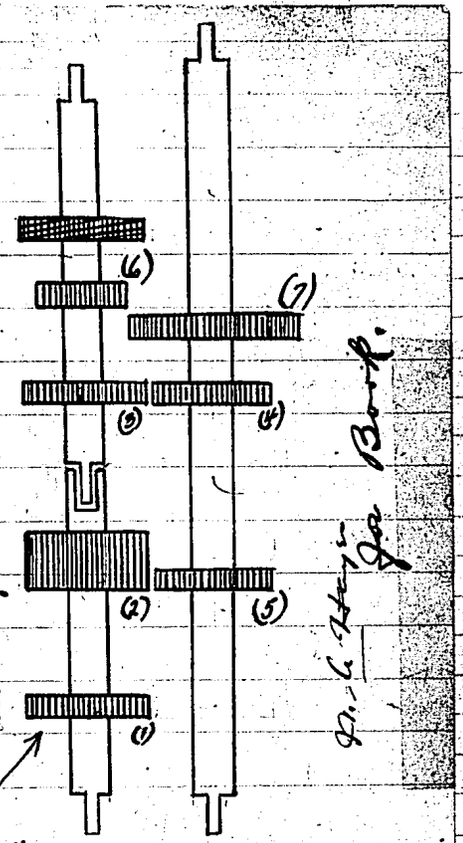

9/32
3/64
Rubber Gasket 1/16

June 20 1922

Attachment for disc refurbishing machine

Converting from 2 from feed to 150 threads to inch

Motor feed 90



A. G. Atkins
Joe Bonk.

Gears

1 — 1.083" Diameter 24 Pitch 24 teeth

2

3

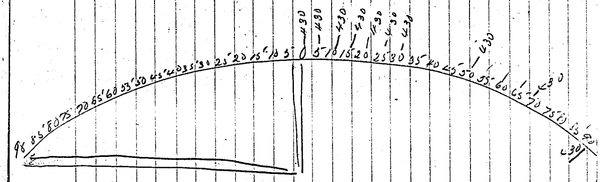
4

5

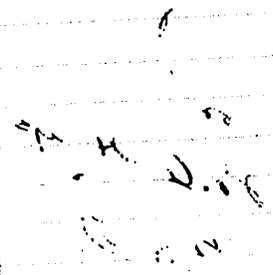
6 — 24 Pitch 18 TEETH .833" diam

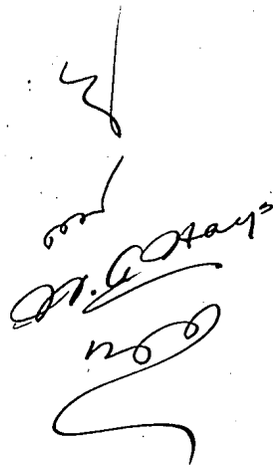
7 — 24 " 30 " 1.333 "

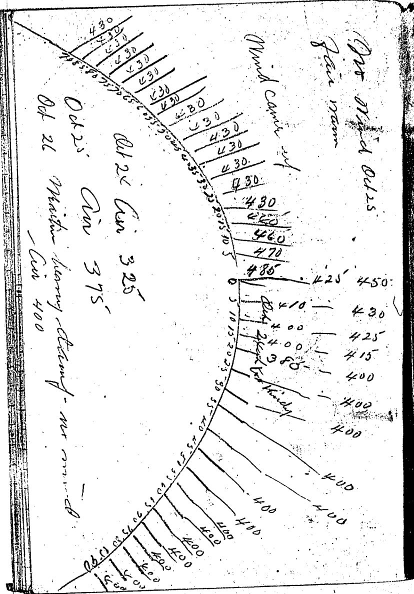
[155]



430
430
430
465
470
475
450
430
435
415
400
400
400







1 1/2 — 1 5/8
2 — 1/4 less
2 1/2 — 1/8 "
3 — 1/8 "

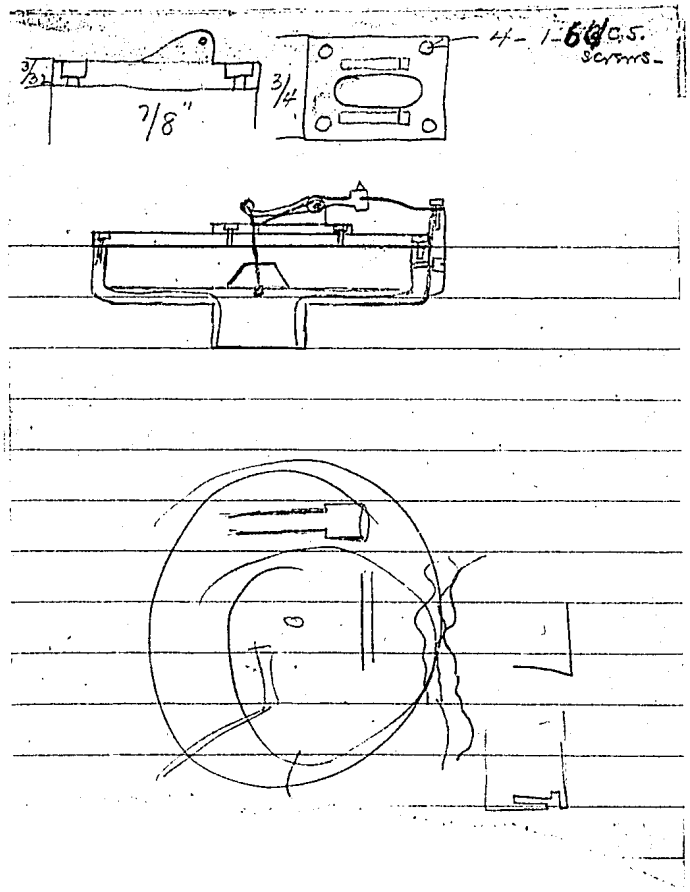
~~4 — 1 5/8~~
~~2 — 1/4 less~~
~~1 — 1/8~~
~~1 — 1/8 "~~

1 9/16
1 1/4
7/8
1/2

Keep to desk, measurements for present.

Δ
Gasket

[ITEM(S) FOUND IN BOOK]



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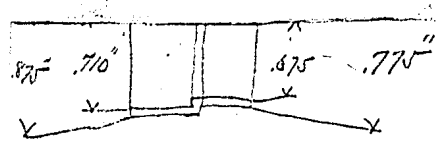
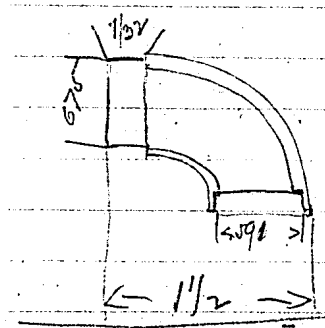
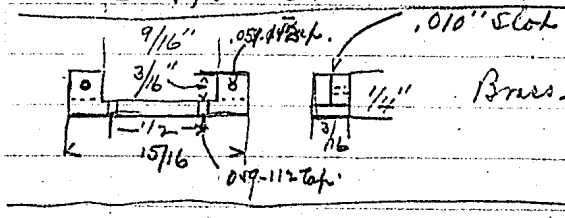
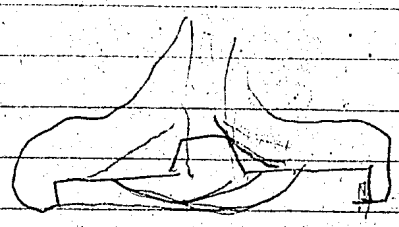


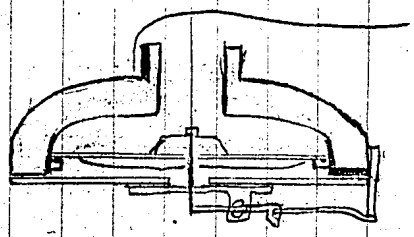






[ITEM(S) FOUND IN BOOK]

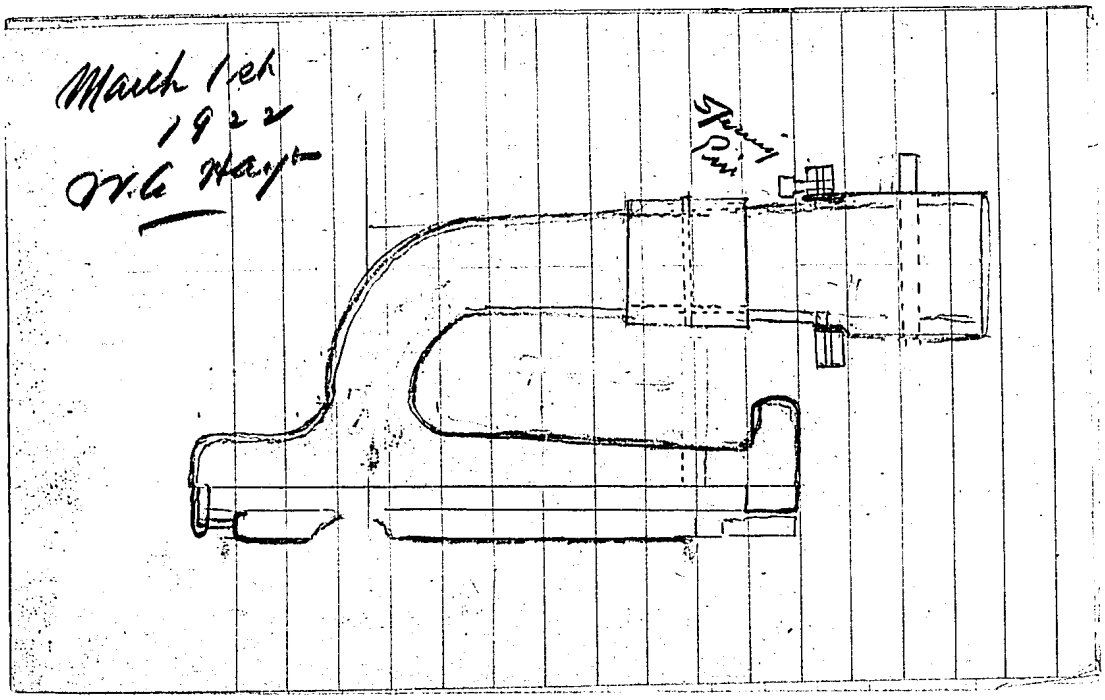
Play Edwin Breakers on Victor and Columbia Machine



Jan 20 1922

W. A. Hayes

[ITEM(S) FOUND IN BOOK]



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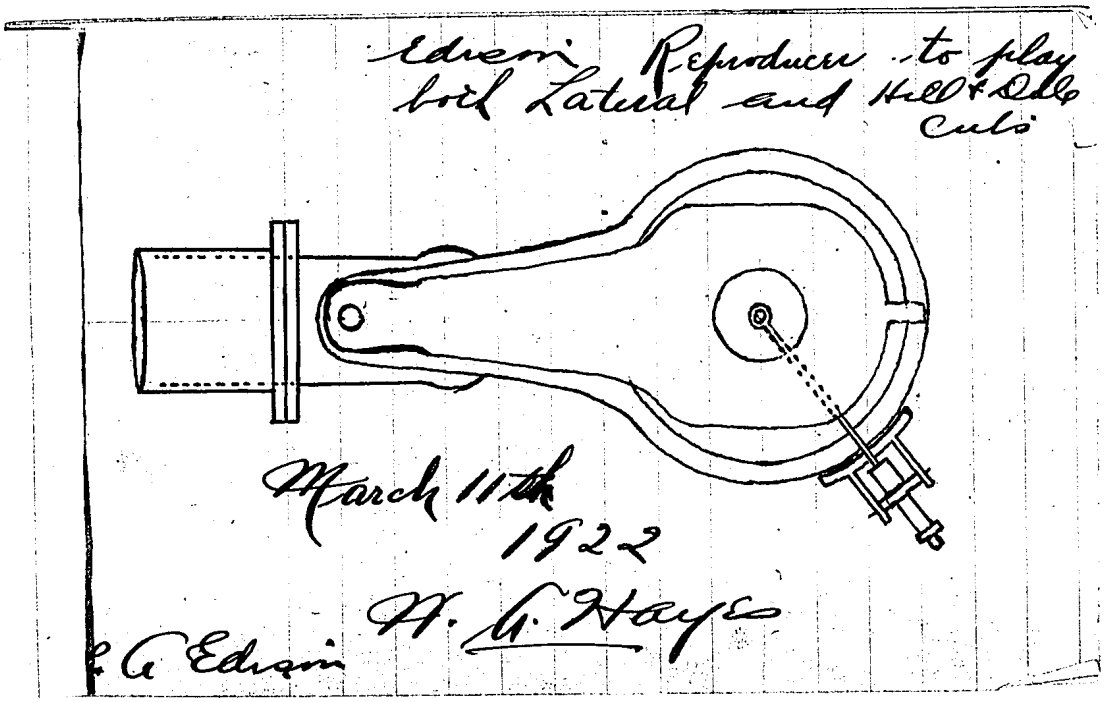

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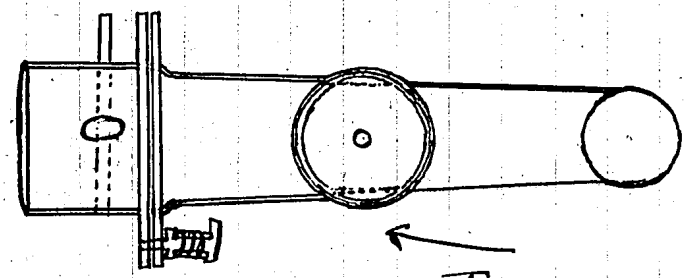

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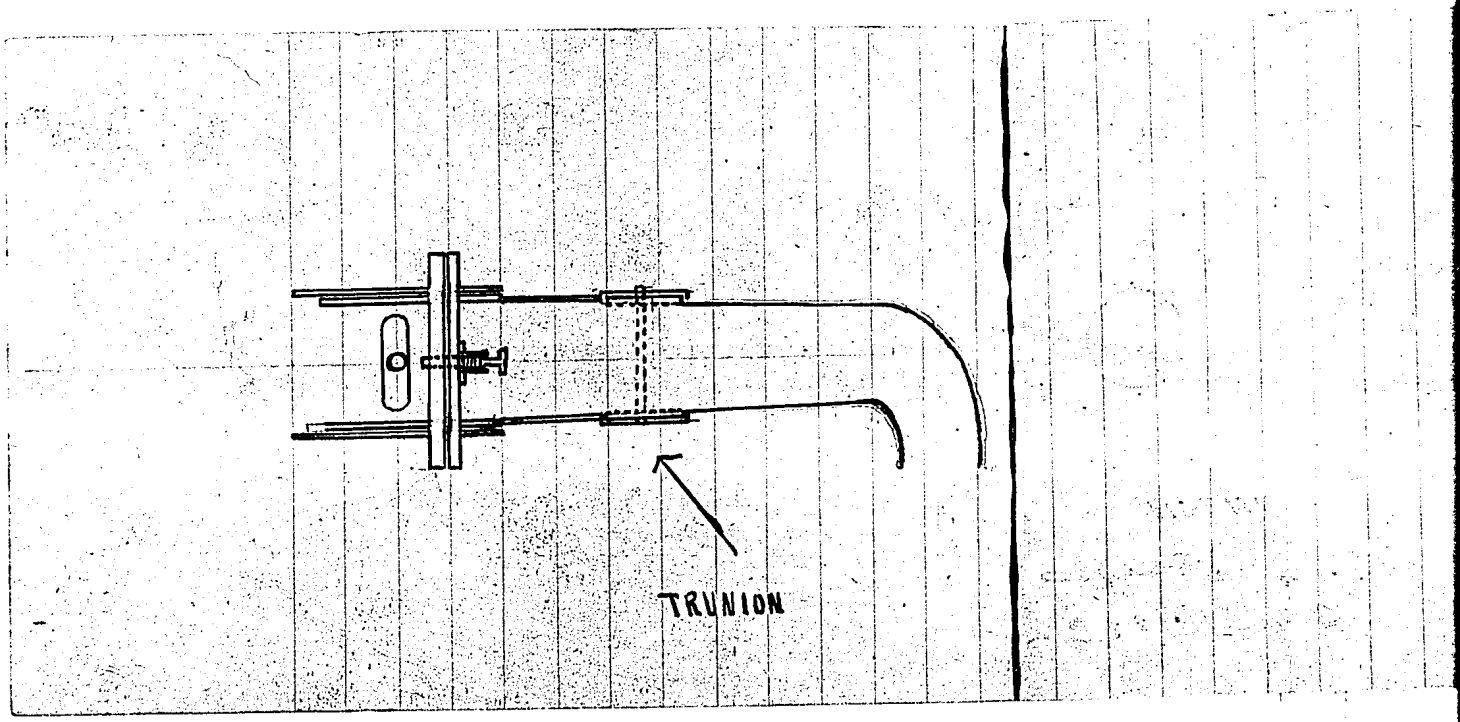

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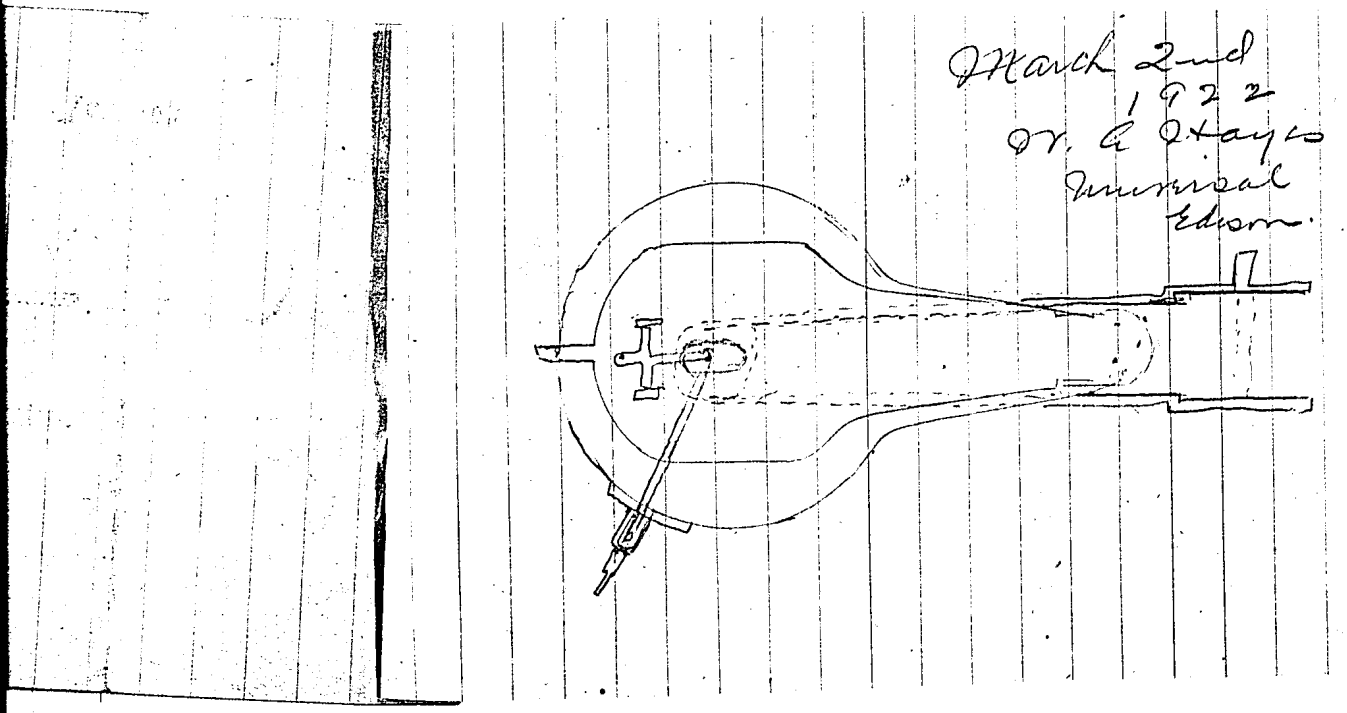

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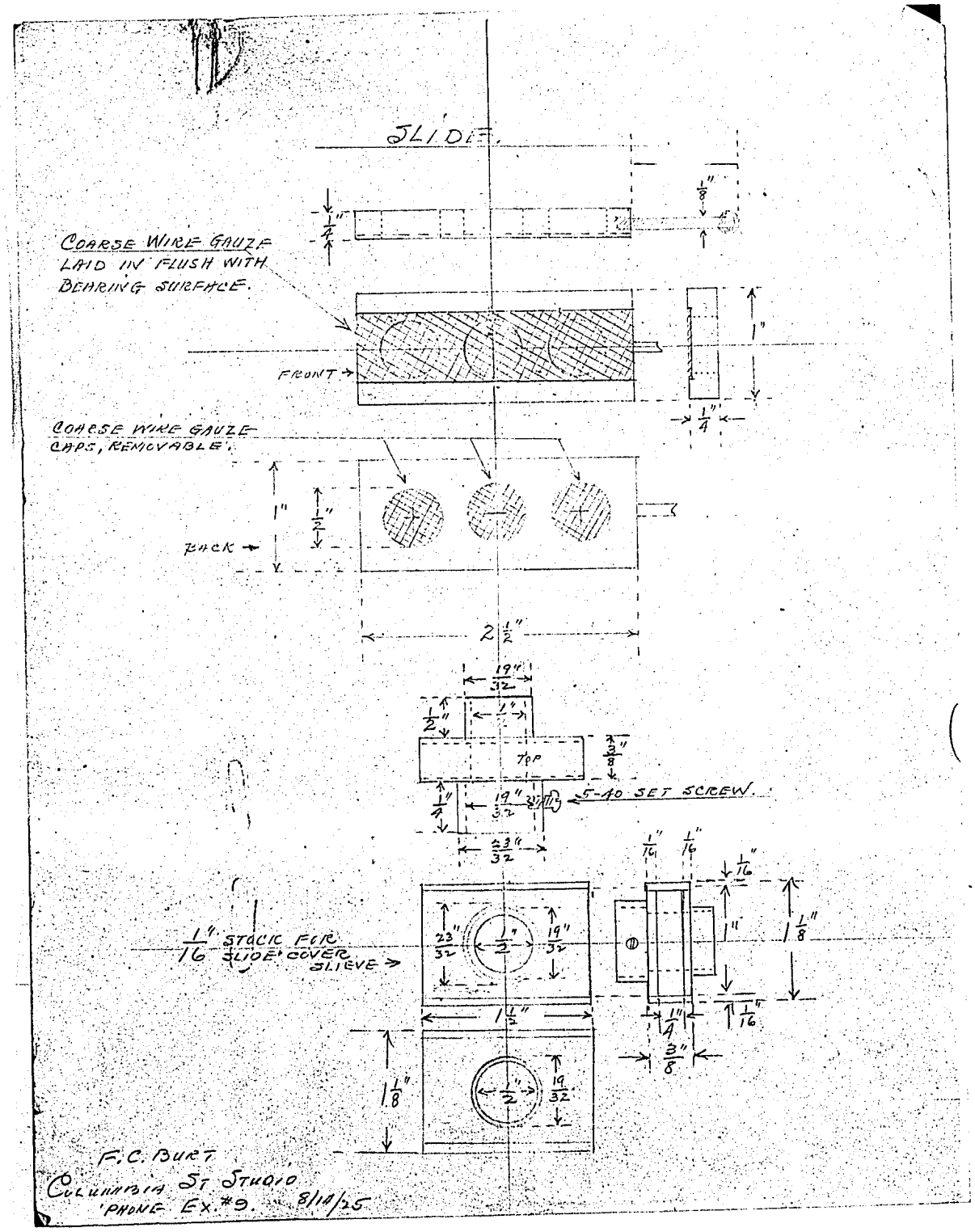

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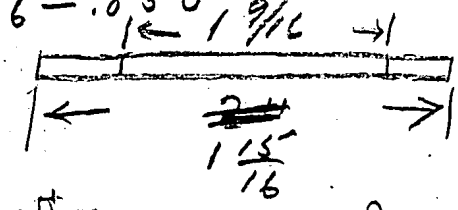
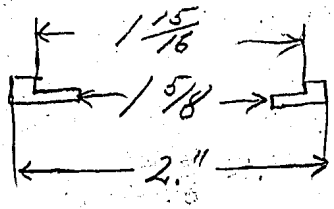
[ON BACK OF PREVIOUS DOCUMENT]

Soft Rubber Gaskets

6 - .045"
6 - .050



4 Brass ring for
iron gaskets



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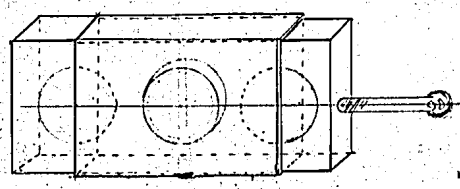
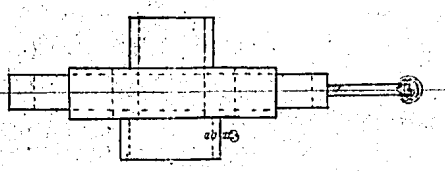
Front



Top



1 REQUIRED OF BRASS OR STEEL.

AIR TIGHT SLIDE WITH 3 ROUND CONTAINERS $\frac{1}{2}$" DIA.

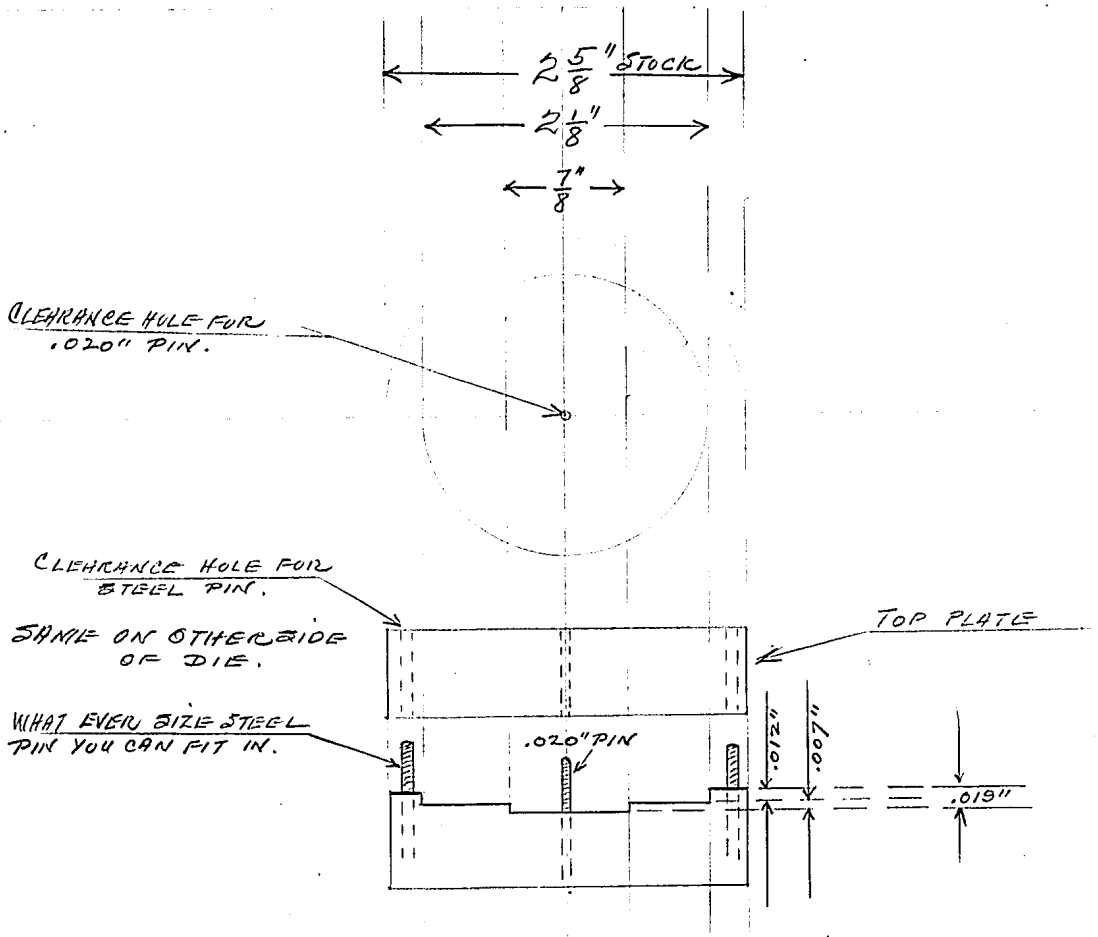
SHOP ORDER #200 X 140 AUGUST 14. 1925.

DELIVER TO COLUMBIA STREET STUDIO.

F. C. BURT

NOT DRAWN TO EXACT SIZE, USE FIGURES.

[ITEM(S) FOUND IN BOOK]



1 REQUIRED

BRASS STOCK WILL BE SUPPLIED BY W. A. HAYES.

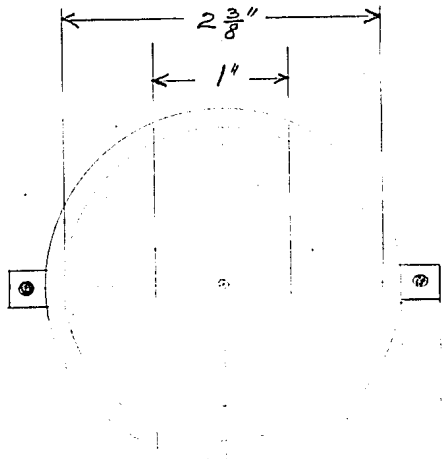
CHARGE S.O. C200X140.

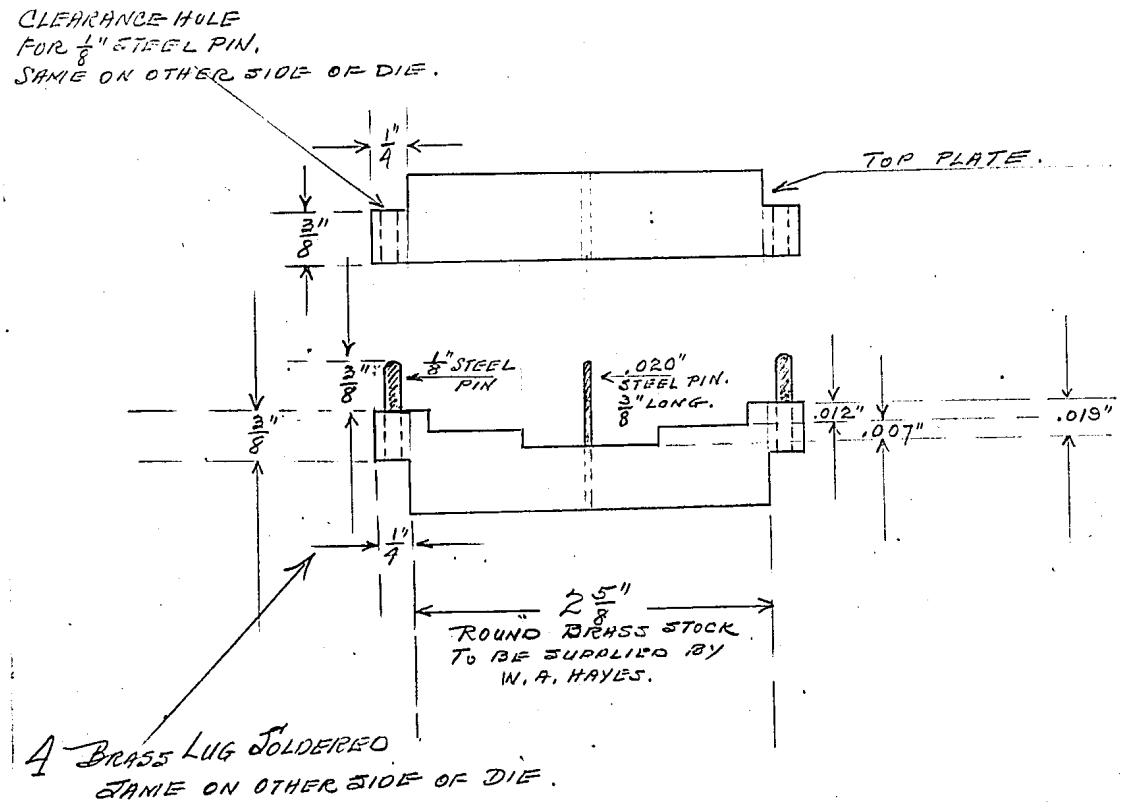
FEB. 10, 1926.

(F.C. BURT.)

COLUMBIA STREET STUDIO

[ITEM(S) FOUND IN BOOK]





1 REQUIRED
CHARGE J. O. C200X140.
FEB. 10, 1926. (F.C. BURT)

COLUMBIA STREET STUDIO.

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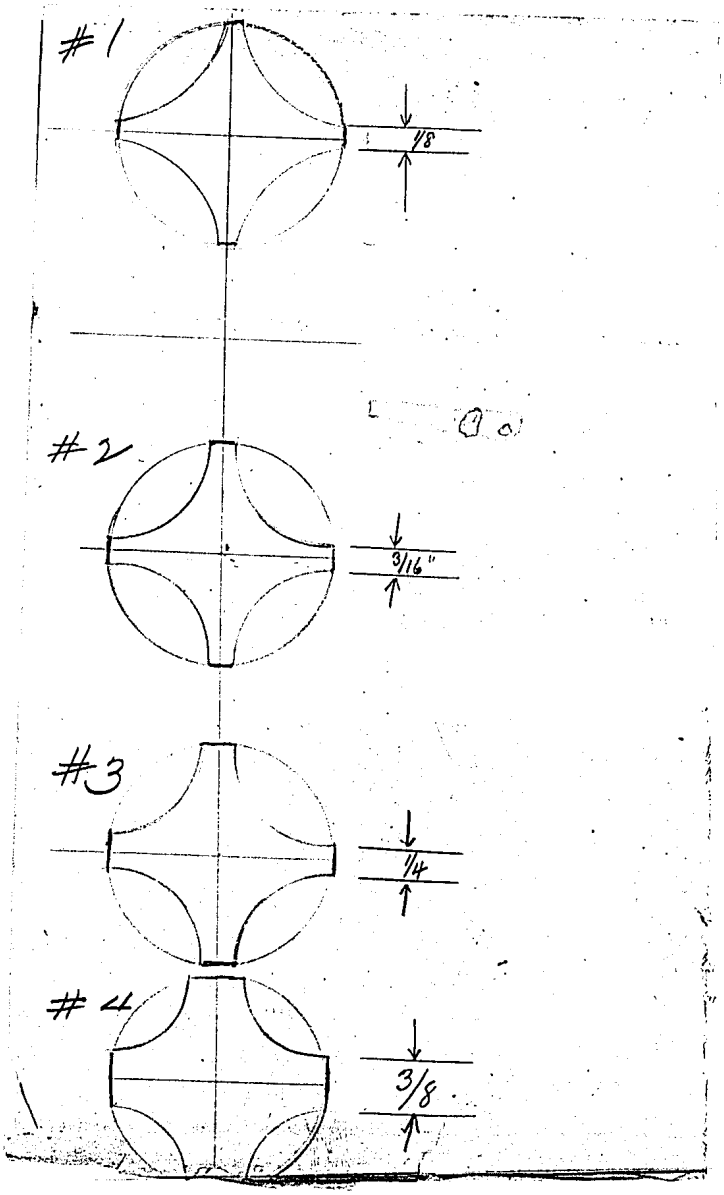

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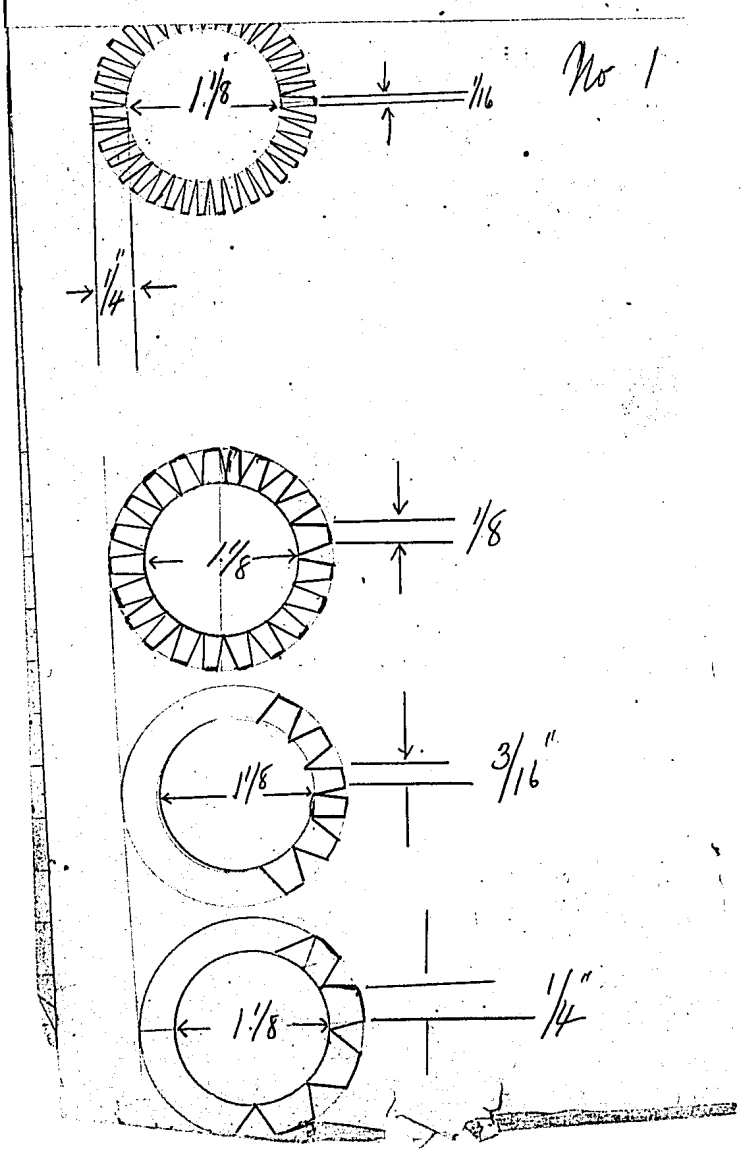

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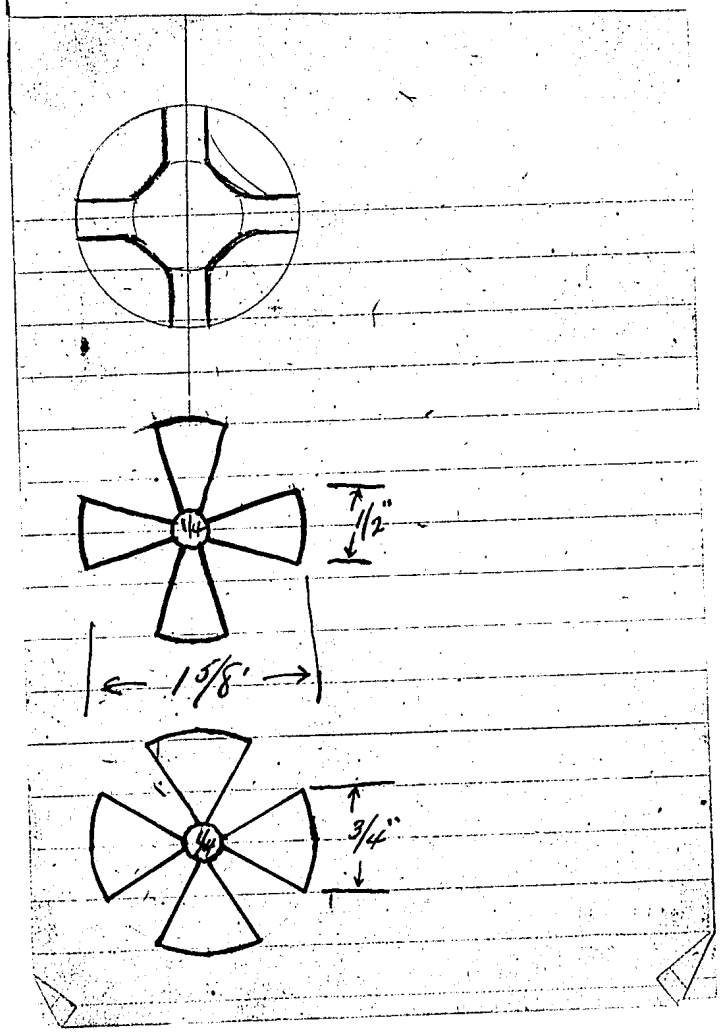

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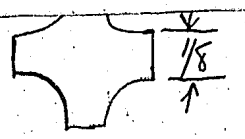
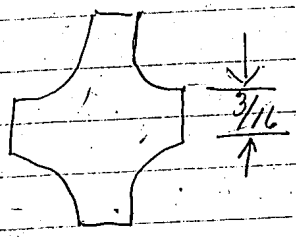
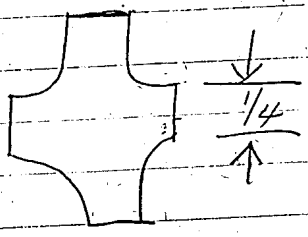


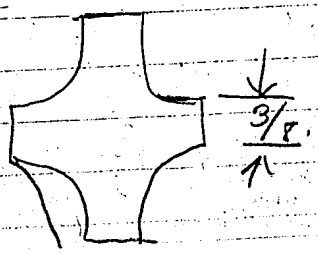
1st Steel



2nd



3rd



4th